

MAN'S PERCEPTION OF MAN-MADE ENVIRONMENT

Sven Hesselgren

COMMUNITY DEVELOPMENT SERIES

MAN'S PERCEPTION OF MAN-MADE ENVIRONMENT

AN ARCHITECTURAL THEORY

BY SVEN HESSELGREN

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Preface

This book is to be looked upon as a comprehensive summary of my book *The Language of Architecture* (published by Studentlitteratur, Lund Sweden, 1969). No arguments will be given here to support the statements; anyone who is interested in the arguments should refer to the *Language*, where I have given a detailed description of those observations, from experiments and/or field studies, which are the basis for the Architectural Theory here forwarded.

INTRODUCTION

1 The Perceptual Process

When we experience something by means of our sense organs, the experience is called a *perception*. Thus we talk of *visual perceptions* when using our eyes, *auditory perceptions* when using our ears, and so on. Fig. 1: 1 gives a survey — a »map» — of those perceptions relevant to Architectural Theory. Some fundamental facts should be stressed at this point:

➤ *Stimulus and Perception.* The first of these facts is that we are not allowed to confuse the stimuli — the external physical entities which can strike a sense organ and thus awaken a latent perception in the mind — with the perceptions themselves, which are mental entities. No one has expressed this circumstance in as clear and convincing a way as Hering, from whom I quote:

»When there is a question of obtaining suitable and strictly defined concepts of the attributes of our perceptions, the first requirement is that these concepts are derived exclusively from the perceptions themselves; that any confusion of the perceptions with their physical or physiological causes is strictly avoided; and that no principle for classification is based on data from the field of these causes. It is remarkable that this requirement, which in reality is self-evident, is still constantly being disregarded, and consequently we often find that painters have a more correct understanding of perception than scientists, physicists, and physiologists, and that even in every-day language there is in many respects greater clarity on this subject than in the literature of physiological optics.»

Hering is talking here specifically about colour, but what he says is relevant to all kinds of perceptions.

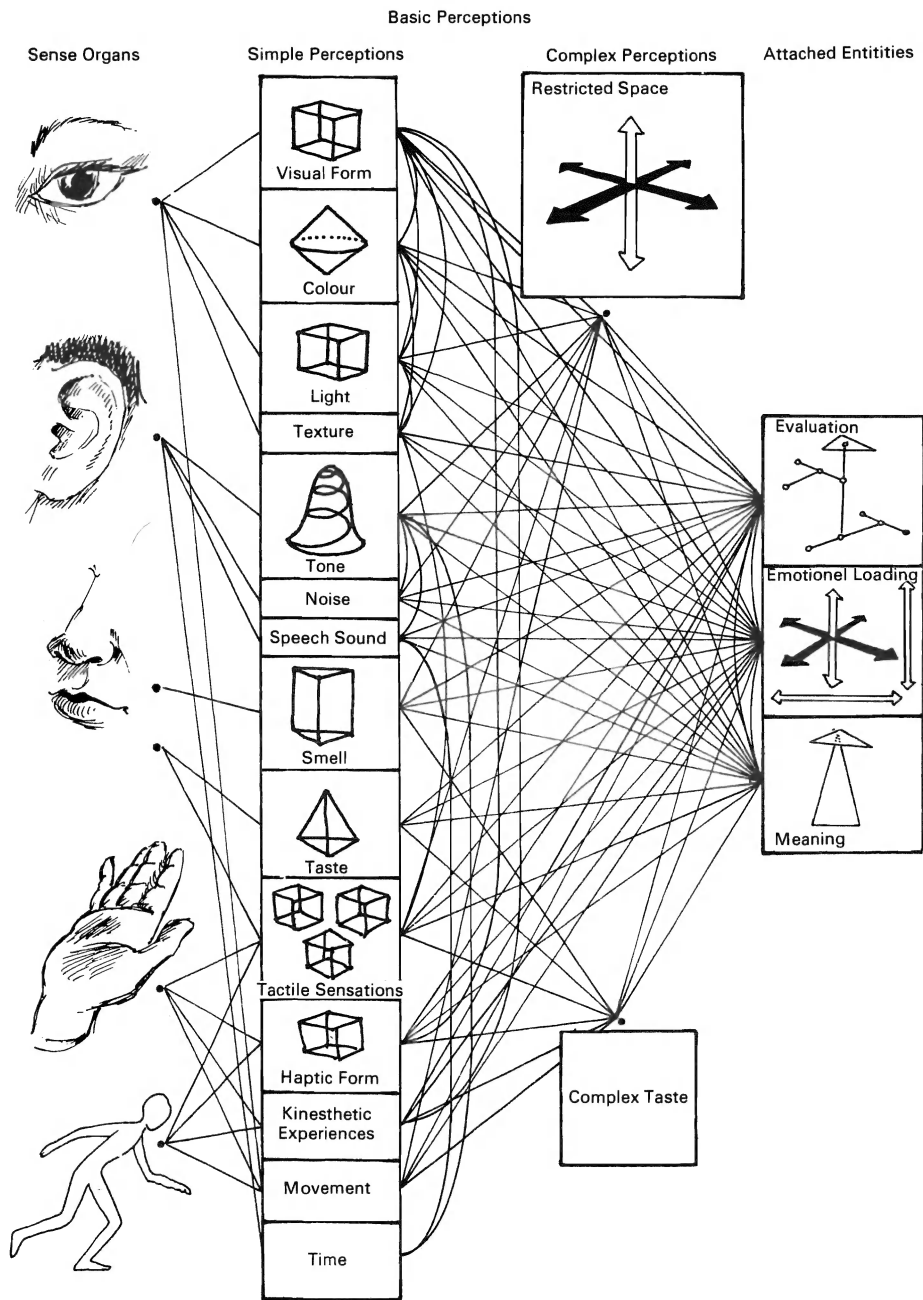
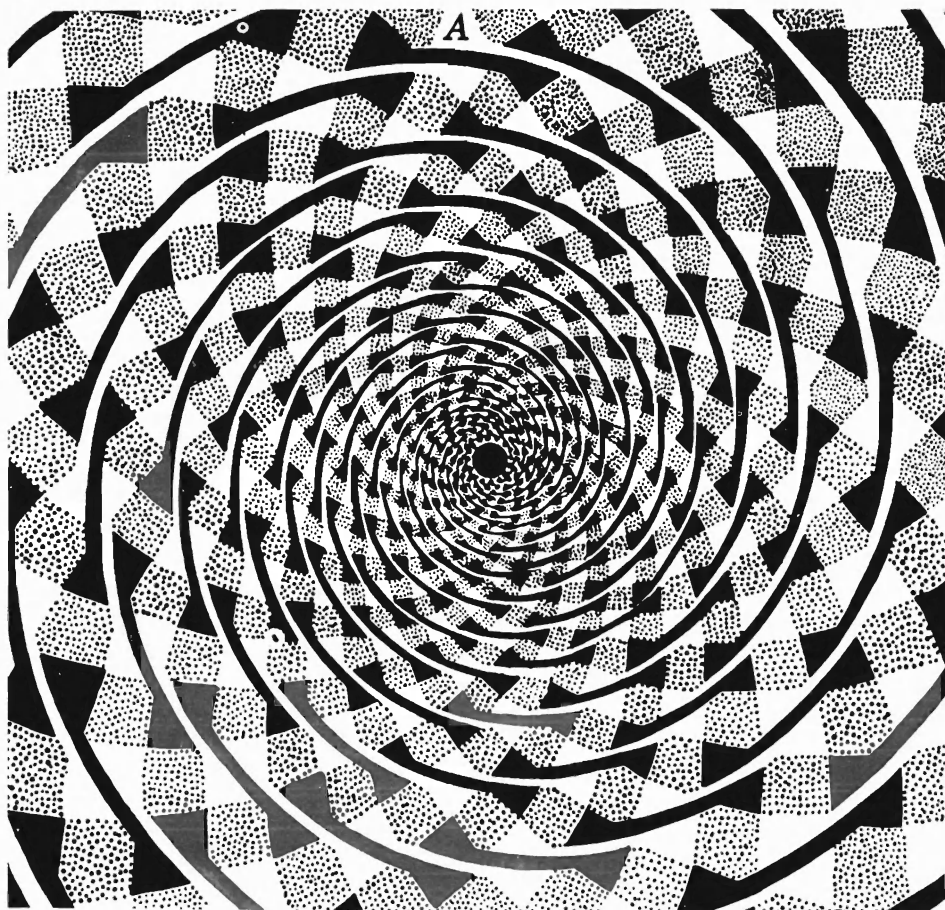


Fig. 1:1.



*Fig. 1:2. Visually,
several spiral lines;
geometrically
a set of circles.*

I take two examples from the realm of the perception of visual form to demonstrate this; Fraser's spirals (Fig. 1: 2) and Poggendorff's «illusion» (Fig. 1: 3). At Fig. 1: 2 we see several lines, which make us think that the stimulus of this perception must consist of geometric spirals. However, if we place a finger on the picture at A and follow the line that passes through this point, we find that after one complete turn our finger returns to A. This means that we cannot always obtain an immediate and correct understanding of the stimulus directly from the perception, and vice versa: knowledge about the stimulus does not always give information about the perception.

Looking at Fig. 1: 3, we see a sloping ribbon drawn with three lines and broken by two rectangles. Perceptually the ribbon continues unbroken behind the rectangles so

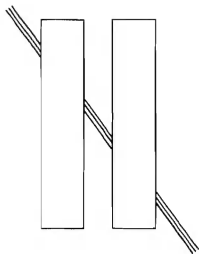


Fig. 1:3. Poggendorff's figure.

that each of the three lines, for instance the left-hand contour line, continues unbroken behind the rectangles. Geometrically, however, the line on the left in the lowest part of the ribbon continues as the middle line of the middle part and the right-hand line of the upper part, as can easily be checked with a ruler. Here again we find an unexpected relation between stimulus and perception.

Categories of Description. If we deepen our analysis we find that the stimuli can always be reduced to descriptions in physical length, mass, and time (for instance centimetres, grams, and seconds: the so-called cgs-system), but the perceptions can never be described in these terms; they must always be described in terms of their own categories.

Phenomenology. Having now understood that we must concentrate our attention on the perception, we soon find that there are different stages, or factors, or elements, in the total perceptual process. Fig. 1: 4 will illustrate this. This drawing by Hill was published in Punch many years ago with the title »My wife and my mother-in-law». At the first sight we see here »the face of a young and beautiful lady», but suddenly this meaning changes into »the face of an old hag». At the same time we can easily feel how our emotion, connected with the meaning, changes. We may also observe that we react in some way, we may perhaps laugh, we may perhaps also appreciate the way in which the artist has made us react; we put an evaluation on our visual perception. Described in other words: black colour on white paper creates a form; this form has one meaning or another; each meaning has an emotional loading of its own; we react. Colour, form, meaning, emotion, reaction; we see these stages or components of the total perceptual process in Fig. 1:1, the "map" of this process. The method of study described here is called Phenomenology.



Fig. 1:4. "My wife and my mother-in-law". Drawing by Hill.

Thus we have found a certain macro-structure in the realm of perception. Studying the different »squares» on the map, we will find that each one has a structure of its own, and we will devote the following chapters to the study of these micro-structures. But first, a few words about the »Reaction square».

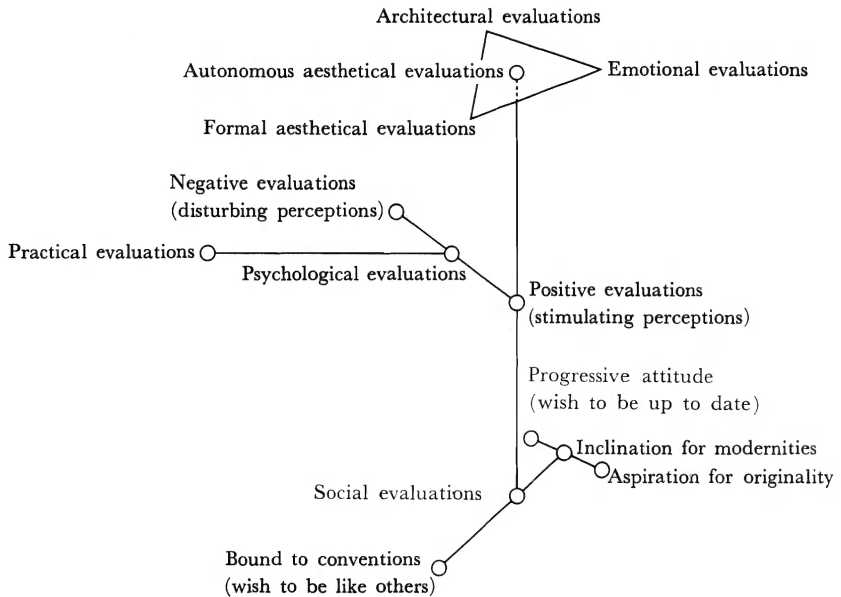


Fig. 2:1. A graphic representation of those evaluations, dealt with in this book.

2 Reaction

A subject's reaction to a perception may be a behaviour which can be studied by an observer, but it can also be an evaluation, which is sometimes reflected in a behaviour but usually cannot be studied using behaviourism. I will concentrate on these »silent» evaluations, which may at the same time be unconscious ones. Fig. 2: 1 gives a diagrammatic representation of the evaluations dealt with in this book.

To describe the facts behind this diagrammatic model let us take an example: buying a car. When we are looking for a car to buy, we probably ask first of all if the car we are interested in will run well, we evaluate it from a practical aspect. But we are also interested in its visual shape, we make a psychological evaluation which can be positive or negative — we like it or we dislike it. Our reason for liking it may be that we look on it as a symbol of status; and this is often the case. Depending on whether we are conservative or progressive, one or another kind of car will be preferred; the model will us give a hint of

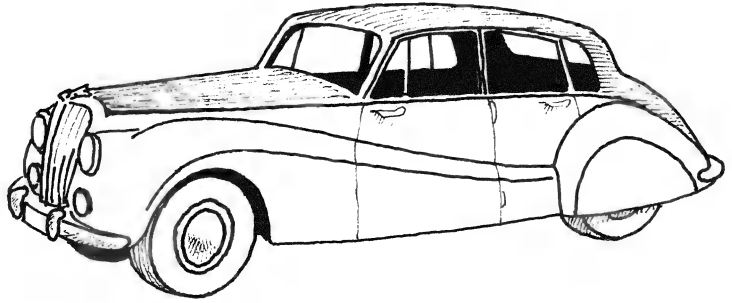


Fig. 2:2. An English car,
once admired for its
formal beauty.

the dimensions in this realm of evaluation. But we can also evaluate it positively (if we find it to be beautiful) or negatively (if we find it to be ugly) from an autonomous aesthetical point of view. An analysis of the car at Fig. 2: 2 will clarify the three main dimensions in evaluation.

We may evaluate the car positively because of its »beautifully sweeping lines«, which means that we take into account some features of the form without thinking about the meaning of the form. But when we take the meaning into account we may find that upon opening the back door we are getting a piece of the front mud-guard in our hand at the same time. Thus the form does not give a clear expression of its function. When we evaluate the »pure« form without thinking about its meaning, we make, to use the art theorist's terminology, *formal aesthetic evaluation* and when we evaluate the way in which a form tells us about the function of the object we make an *architectural aesthetic evaluation* (author's terminology). We may, perhaps, also evaluate the emotional loading of the form and/or its meaning. However, we do not need to penetrate this matter more deeply just now; it will be taken up again in a later chapter.

If we now look at Fig. 1: 1 once more we will find a network of lines connecting the separate »squares«. Among these lines we find that there are some that lead from the reaction square to each of the squares to the left. These represent the formal aesthetic evaluations of the various kinds of »pure perceptions«. We also find lines from evaluation to meaning and from evaluation to emotion; these are representations of the architectural and emotional aesthetic evaluations.

If we study the »pure perceptions» as isolated phenomena — and this is the way I have treated the subject in my book *The Language of Architecture* — it is perhaps a little difficult to understand how relevant this study might be to Architectural Theory; but if we combine the study of »pure perceptions» with the study of »formal aesthetics» we find a lot of interesting facts. This is the reason for the layout of this book.

II BASIC PERCEPTIONS AND FORMAL AESTHETICS

3 Visual Form

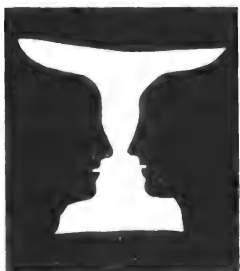


Fig. 3:1. Rubin's classical demonstration of figure and background.

There are two kinds of form perceptions: visual forms which we perceive by means of our eyes, and haptic forms which we perceive by means of our hands or some other part of the body. Blind people have haptic form perceptions but no visual form perceptions. Haptic form perception will be studied in a later chapter.

Figure and Ground. A visual form is (almost) always perceived as a figure against a background. Fig. 3: 1 shows Rubin's classical figure-and-ground demonstration. Here we usually first perceive a white vase against a black background. But suddenly the experience changes and we see two black faces looking at each other, and they are perceived as figures against a white background.



Fig. 3:2. Reversible figure-background. Composition by Escher.

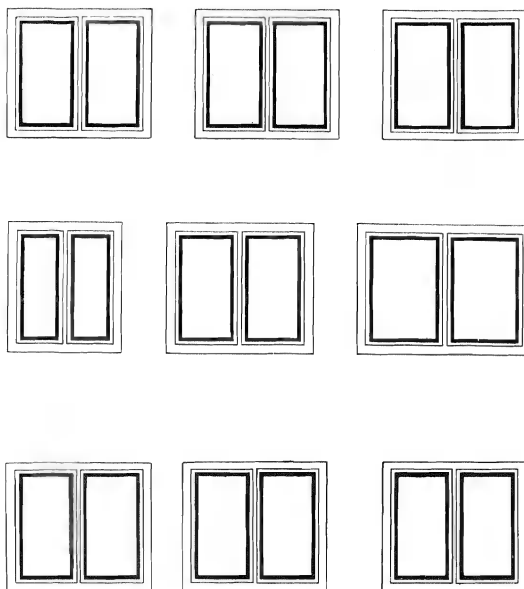


Fig. 3:3. Changed proportion of figures are more obvious than changed distances between them.

An application of this phenomenon in a piece of art is shown at Fig. 3: 2, a drawing by Escher. When the knights riding to the right are perceived as figures the knights riding to the left are perceived as background, and vice versa. The two kinds of figures are exactly identical, but mirrored.

We are much more sensitive to the figure than to the background, as is demonstrated by Fig. 3: 3. The three windows at the top are perceived as figures against the wall as background. A slight shift in proportion of the figures is immediately observed as something disturbing, as the windows in the middle show, but if we maintain the proportions of the figures while changing the distances between them this change in the background is scarcely observed; see the three windows at the bottom of Fig. 3: 3.



Fig. 3:4. A little town as figure against the landscape as background. Halen in Switzerland. Architects, Fritz et al.

Fig. 3:5. Figures with and without contour-lines. (After Burchartz.)

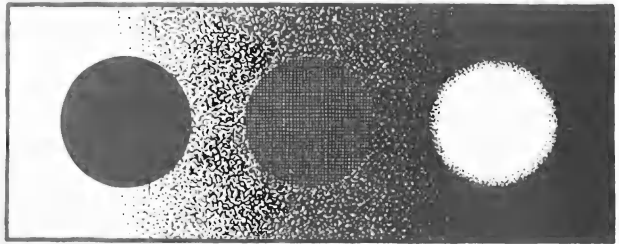


Fig. 3:6. Figure without contour-line.

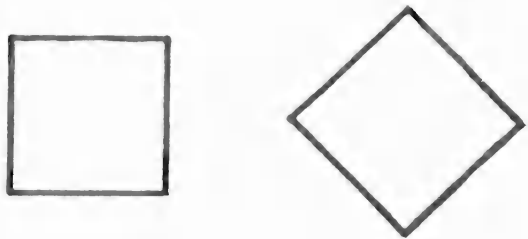


Fig. 3:7. Square and diamond. (After Schumann.)

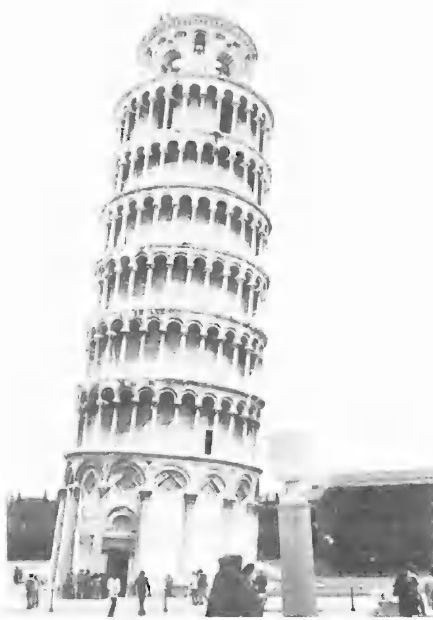


Fig. 3:8. The sloping tower in Pisa.

The application of the figure-and-ground-phenomenon can even be noticed on a greater scale, in architecture. Thus Fig. 3: 4 shows the exterior of Halen, a very small town outside Basel in Switzerland, where the architects have consciously created something which will be perceived as a »town figure» against the background of the wooded landscape. It is said that this circumstance makes a strong contribution to the inhabitants' feeling of »being at home» in their little town. In older times this effect of »town figure» on »landscape background» was very often achieved unconsciously, by "natural growth".

A figure can have either sharp contours or blurred contours, as is shown in Fig. 3: 5. This illustration also shows how the colouring can strengthen the figure, grey figures on grey background being »weaker» than white against black. Sometimes we perceive a contour even when there geometrically speaking is none, see Fig. 3: 6.

The Visual Main Directions. If we look at Fig. 3: 7 we see that the figure on the right is larger than the one on the left and has quite a different character. If we measure the sides of these forms by means of a pair of dividers,



*Fig. 3:9. The concert hall in Gothenburg.
Architect, Eriksson.*

however, we find that they are geometrically congruent. The difference in perception depends on the fact that they are differently situated in relation to the two visual main directions, up-down and sideways. These visual main directions play an important role in architecture, the up-and-down direction especially.

This has been very nicely expressed by Lowenfeld; I quote: »The perpendicular line, the most *absolute* line, which is neither influenced from the left nor from the right, expresses the same *stability* that a flag-pole expresses as the bearer of the symbol of the nation.»

What is said here is demonstrated by the leaning tower in Pisa; see Fig. 3: 8. When perceiving this we experience a



Fig. 3:10. The pregnant right angle.

terrifying feeling of uncertainty. However, something important should be emphasized here. Lowenfeld, in the quotation above, seems to have put a sign of equality between the plumbline and the visual up-down direction. The correlation between stimulus and perception, however, is more complicated than this. The stimulus is most often the plumbline, but sometimes it is not. Fig. 3: 9 gives an example of this. In the concert hall in Gothenburg the light fittings were originally hanging geometrically vertical in their wires, but they were found to be perceptibly sloping. Therefore they were later fixed so that the wires became parallel to the walls (which for acoustical reasons are not geometrically vertical), and now the wires were perceived to be in the desired upright direction.

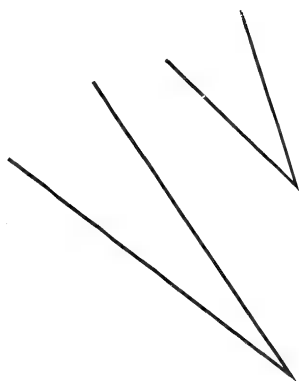


Fig. 3:11. Two acute angles, visually nearly equal, geometrically very different.

The Right Angle. There is a phenomenon closely connected with the visual main directions, namely the perceptual right angle. Look at Fig. 3: 10. It shows a series of angles passing from acute over right angle to obtuse. The right angle is easily detected, and a slight deviation from it is immediately perceived. All the angles to the left in this illustration are obtuse, all the ones to the right are acute, but there is only one which is a right angle. The right angle acts as the changing point of character. Now look at Fig. 3: 11. It shows two acute angles which are perceived to be very similar, almost equal. However, the one is 20 and the other 30 degrees; they are geometrically greatly different but perceptibly almost the same. What we have studied here can be summarized as follows:

The right angle is a structuring phenomenon, it is the changing point of character of angles. The specific character of the right angle is stressed in every-day language:

there is only *one* right angle but all acute angles are grouped together, as are all obtuse angles on the other hand. It may also be added that if the circumstances allow we have a tendency to »wish» to experience a right angle.

Visual Depth. A visual form is not perceived only in relation to the two visual main directions up-down and side-ways; we also have a third dimension, the visual depth. Perception psychologists have asked: how can it be that we perceive a visual depth when we only have a two-dimensional retinal image? For Architectural Theory it is sufficient to state that we *have* a three-dimensional visual perception. It might, however, be of some interest to see what »cues» or »factors» are operative in this.

To most people it seems at first glance self-evident that the most important factor is stereoscopic vision, which means that our two eyes receive different retinal images of one and the same physical object; two images which in the mind are combined to one perception. There are also other factors which depend on the fact that we have two eyes: these factors have by tradition been called the »primary» factors. They are: ocular convergence, accommodation, and stereoscopy.

It is, however, a well-known fact that even a person who is blind in one eye has rather good perception of visual depth. The factors that operate in such a case are the »secondary» factors. The eight »secondary» factors, which are thus the most important ones, are the following: superposition, size and perspective, light and shade, aerial perspective, filled and empty distance, parallax of movement, reversible perspective, and the height location of the object. These can be described briefly as follows:

Superposition as a »criterion of depth» is demonstrated in Fig. 3: 12, where we see in the middle three equally large cardboard squares, one behind the other, and to the right a small playing-card in the foreground and a large one in the background. Fig. 3: 13 shows the demonstration equipment: there are in fact two equally large playing-cards, for example, and the six of spades is actually furthest away. In spite of what we might know about this

Fig. 3:12. Superposition as a criterion of depth.

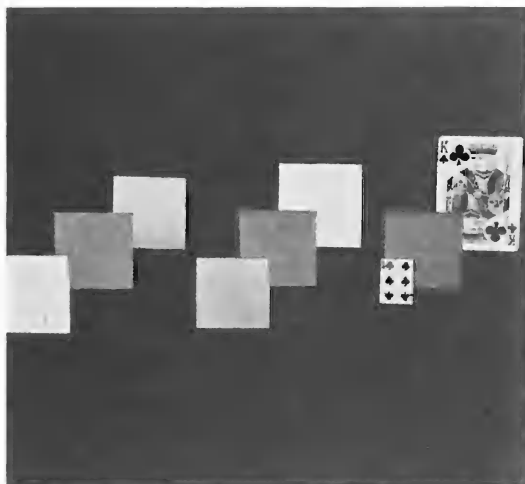


Fig. 3:13. The arrangement of the experiment at Fig. 3:12. (After Ames.)

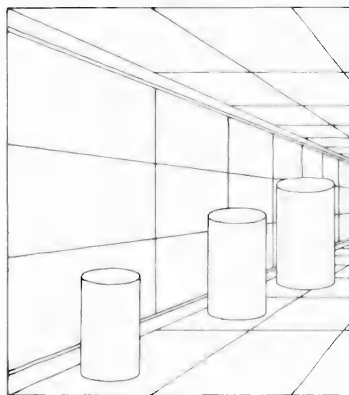
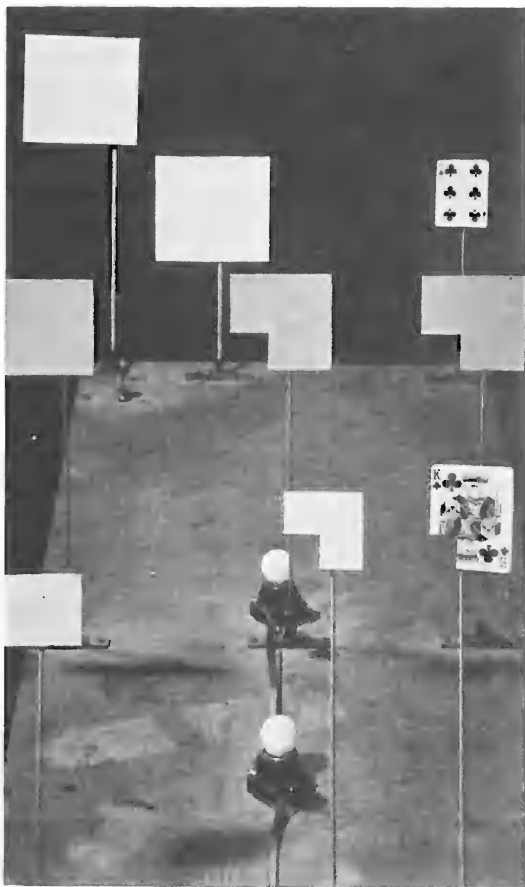


Fig. 3:14. Three cylinders, visually different, geometrically equal in size. (After Gibson.)

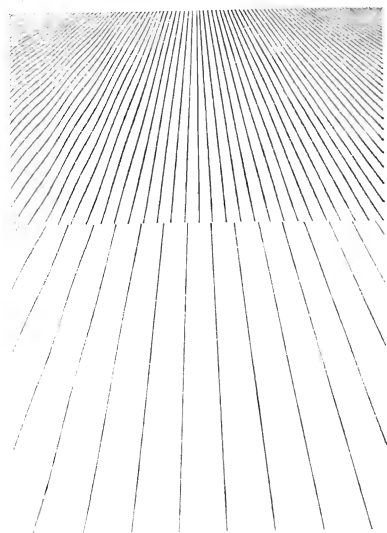
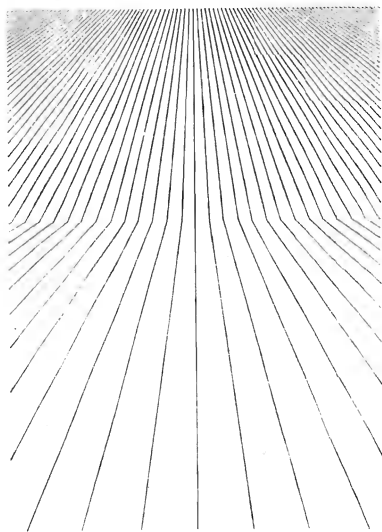


Fig. 3:15. Gibson's "texture gradient" is an example of the factor of size and perspective.



external physical situation we cannot avoid perceiving a small six of spades as the nearest playing-card in Fig. 3: 12; the factor of superposition is in function. This demonstration, and many others, was created by Ames.

The factor of *size and perspective* is demonstrated in Fig. 3: 14. The three cylinders are geometrically equal in size, but are perceived unequal as the result of the perspective drawing in the background. A particular case of perspective is shown in Fig. 3:15 where the perspective lines indicate a corner and an edge. This class of phenomena have been especially investigated by Gibson who calls them »texture gradients».

Light and shade as factors or »cues» in visual depth are demonstrated in Fig. 3: 16 where we see at the top exactly where the ball is situated in relation to the wall and floor, but where we at the bottom are not sure of this.

Atmospheric perspective means that distant objects are often bluish and have blurred contours and less distinct details.

A *filled distance* has a tendency to be perceived as a more pronounced visual depth than an empty distance.



Fig. 3:16. With suitable shading we can determine the position of the ball. (After Pleijel.)

Fig. 3:18. Relationships of depth by vertical location. (After Kepes.)

Parallax of movement means that if we look at moving objects, or at static objects while we ourselves are moving, then the visual depth is strengthened.

Reversible perspective is demonstrated in Fig. 3:17, Necker's prism. It is hardly possible to avoid the impression of visual depth in this figure. If we look at the corner N it will enter the foreground, but if we shift our gaze to M, this corner comes into the foreground instead. This factor is, however, seldom operative in every-day situations.

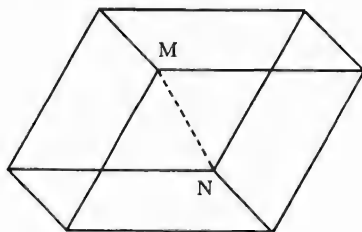
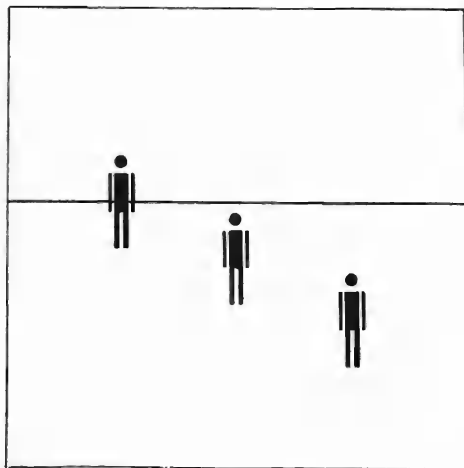


Fig. 3:17. Necker's figure.

Fig. 3: 18, after Kepes, demonstrates the relationship between visual depth and the *vertical location* of the object; the higher up in the field of vision, the nearer the horizon and the greater the distance away.

The different factors of visual depth can sometimes be contradictory, as can be seen in Fig. 3: 12, where size and height location are contradictory but where superposition is the decisive factor.



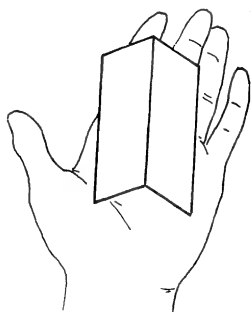


Fig. 3:19. *Mach's book.*

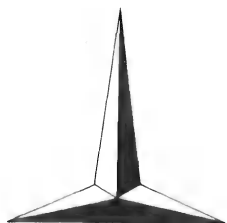


Fig. 3:20. *Vertical and horizontal distances, visually different, geometrically equal.*

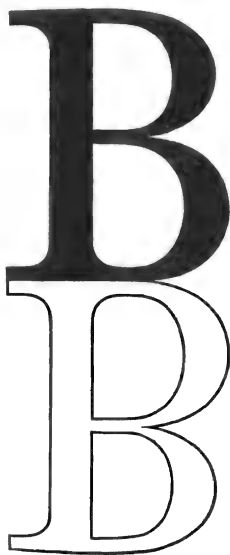


Fig. 3:21. *The B-phenomenon.*

I want to finish these lines about visual depth with a description of »Mach's book«, which will demonstrate how impossible it is to escape from the experience of visual depth. Hold a piece of folded paper in the hand and observe it with monocular vision, as shown in Fig. 3: 19. The impression that the spine of the book has a different location in depth than the edges of the pages cannot be avoided, but it is almost impossible to determine whether the spine is nearest or furthest away.

Perceived Distance. Perceived distance is not the same as physical (geometrical) distance. The same physical distance is not always perceived to be the same. Look at Fig. 3: 20, the trade mark of an English firm. The vertical distance is perceived longer than the horizontal, but geometrically they are equal, which can be checked by means of a pair of dividers. And look at Fig. 3: 21, demonstrating the »B-phenomenon«. The upper part of the black letter B is perceived to be equal to the lower part, but the image reflected below (the white letter B) reveals that the geometric stimulus is otherwise.

These observations can be summarized by saying that the stimulus for perceived distance is not just the geometrical distance as a separate phenomenon, but the geometric distance seen as a part of the total field; and in the field of perception the visual main directions act as structuring phenomena. It is also apparent that upwards from the visual centre and downwards from it mean different things. In company with Russell we might be allowed to talk about the up-down-direction as composed of two: upwards from the centre and downwards from it.

Curved Lines. I have talked until now about the perception of straight lines. The perception of curved lines, however, offers a problem of special interest to Architectural Theory.

During some periods of Architectural History, large architectural details with curved boundary lines have been in favour. Fig. 3: 22 gives one example, the entrance to a building in Stockholm designed in 1888 by Clason. The curves above the entrance are not ellipses but are made up of a combination of circular segments in

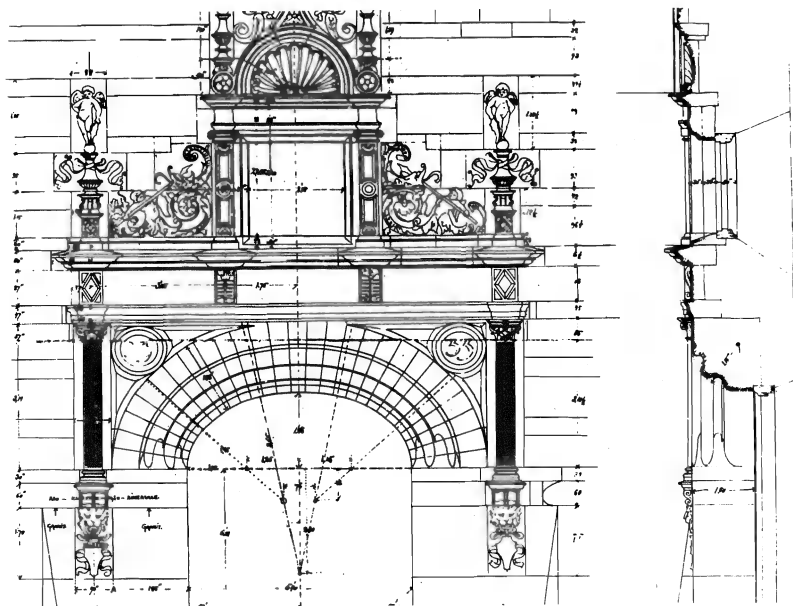


Fig. 3:22. The multiple-arch curve applied to the entrance of a building. Architect, Clason.

such a way that adjacent arcs have the same tangent at the point where they join. It was thought that this would create a continuously and smoothly curved line. This is, however, not always so, see Fig. 3:23. In this illustration we perceive indentations or jerks in the curve at the points where the radius of the curve suddenly changes; the phenomenon is especially apparent in the upper figure in this illustration. The common tangent does not suffice to make the curve perceptibly smooth. Mach has expressed this in the following way:

»On the value of d^2y/dx^2 the eye gives qualitative information.»

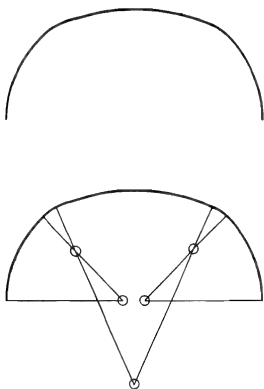


Fig. 3:23. A multiple-arch curve.

This means that not only must there be a common tangent at the point where the different parts of the curve join but the radius of the curve must also change in a continuous way, and not suddenly. It is, however, possible to find a class of mathematical equations for a certain kind of curve similar to the almost elliptic used in Fig. 3: 22, which fulfill this condition.

One could of course consider that the best way to achieve a line that will be perceived to be continuously curved

Fig. 3:24. Table with smoothly curved contourline. Designer, the author.

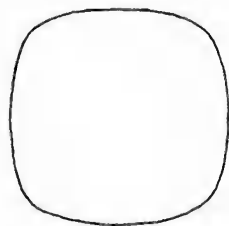
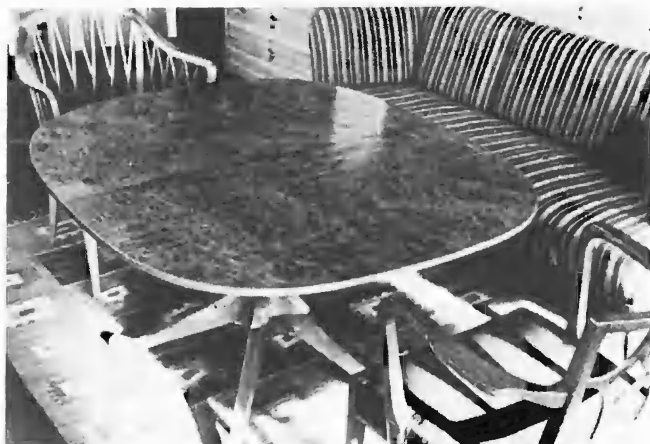


Fig. 3:25. Supercircle. (After Hein.)

would be to use one's own subjective estimation, and this is what I did once upon a time when I designed the table shown in Fig. 3: 24. Some years later, however, the Danish designer Piet Hein studied the curves which are the graphic representations of mathematical equations like the following:

$$(x/a)^n + (y/b)^n = 1$$

By changing the exponent one can describe a series of curves which Hein has called superellipses (or super-circles, if the two axes are equal in length), and from these series he has chosen some which he finds to have a specific character (which would perhaps mean that there is a pregnant form between square and fully rounded, see later under the sub-heading Attributes of Simple Forms). Fig. 3: 25 shows his super-circle form, which he has used for the design of a table, see Fig. 30: 26. I would like to draw your attention to the similarity between this table and my own in Fig. 3: 24. An application of Hein's super-ellipse was found when Sergels Torg, a new »square» in the newly-built centre of Stockholm, was being designed. Fig. 3: 27 shows this super-ellipse, with the equation:

$$(x/22,714)^{5/2} + (y/20,150)^{5/2} = 1$$

For comparison Fig. 3: 28 shows an ordinary ellipse with the same axes, having the equation:

$$(x/22,714)^2 + (y/20,150)^2 = 1$$

Fig. 3:26. Table with supercircle contour-line. Designers, Hein and Mathsson.



and Fig. 3: 29 shows how the Sergels Torg looks after it has been built.

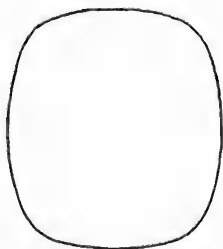


Fig. 3:27. *Superellipse*

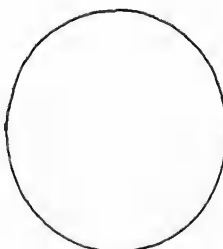


Fig. 3:28. *Ordinary ellipse*

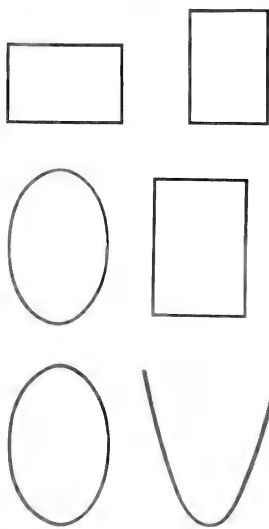
Attributes of Simple Forms. Up to now we have mainly discussed the character of the boundary lines of forms. It is also of interest to study the forms themselves. When we do so we find to begin with that a form is perceived simultaneously, at one glance, while a (contour) line is perceived successively, the visual attention moving along it.

We will start our study with the simplest of forms. Fig. 3: 30 shows at the top the difference between the attributes recumbency and erectness, both figures being angular. We might say that these figures differ in proportion. The next figures show that an erect figure can be either angular or rounded. The last pair shows two erect, rounded figures, one having closed character, the other open character.

Let us now study the proportions in Fig. 3: 31. We see on the left a proportion that is definitely recumbent and the recumbency evidently decreases going right along the series. The proportion at extreme right is pronouncedly erect. We pass from recumbency to erectness via a form that is neither recumbent nor erect, it is indifferent; we will call it a *square*. This indifferent proportion has two

Fig. 3:29. *Sergels torg in Stockholm. Designer, Hein, architect, Helldén.*





features: it is easily detected, and it represents a change of character of proportion. Thus it is a structuring phenomenon of interest to Architectural Theory. Its stimulus is not a geometrically perfect quadrature the height being roughly $1/7 - 1/8$ less than the width geometrically speaking.

When we move away from the square towards the left there is to begin with a large amount of »indifference» mixed with the recumbency, but this trace of indifference subsequently decreases, and at a certain point it disappears. I have found the geometrical stimulus for the point of disappearance to be close to, but not always exactly equal to, the geometric proportion 5: 8 (the »golden section»). The same holds good for the point where the indifference disappears in the sequence of increasingly erect proportions.

Fig. 3:30. Three attributes of simple forms.

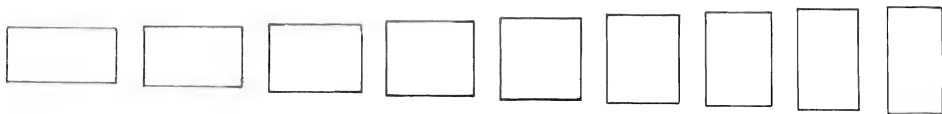


Fig. 3:31. From recumbent through indifferent to erect.

Fig. 3: 32 shows a series of forms from square to round. The corners of the square are here increasingly »rounded off» at the same time as the sides of the square are bending successively outwards. Next to the square is a »nearly-square», then follows a distorted square, intermediate forms between square and round, nearly-round and at the other end a fully rounded form. We can easily find that a series of forms with this geometry can be achieved using the mathematical equation for »supercircles» described above.

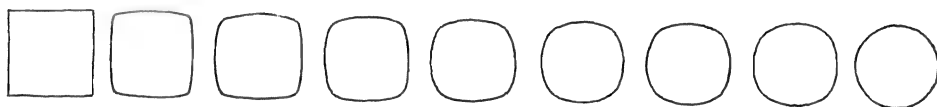


Fig. 3:32. From square through supercircle to round.

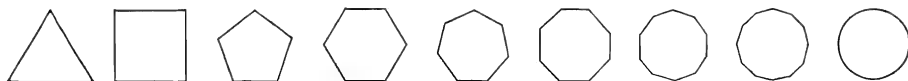


Fig. 3:33. From triangle to round in discontinuous steps.

However, a form can change from angular to rounded in another way. Fig. 3: 33 shows a series of forms from triangular to round, with discontinuous steps. Fig. 3: 34 shows a series of forms from triangle to square where the forms near the triangle are perceived as triangles with one corner cut, as »defective triangles»; adjacent to the square are some »defective squares». Thus from the point of view of perception there is a continuous series of intermediate links between triangle and square, from square to pentagon, etc.

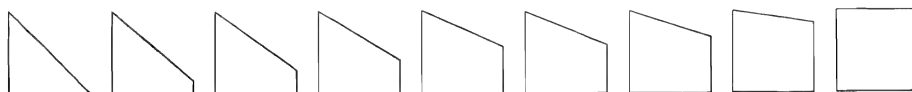


Fig. 3:34. From triangle to square in a continuous series.

Fig. 3: 35 shows a closed, a half open, and a wide open form. We might easily imagine a series of continuously changing forms between these extremes.

Let us now summarize what we have found so far by means of a diagrammatic representation.

Fig. 3: 36 shows a diagram of the attributes angular-round and proportion. We find here the extremes of the attributes, discussed above, and also some intermediate forms. We find, however, no place for the attribute closed-open. In order to include this we must use a third dimension, as shown in Fig. 3: 37. This three-dimensional model only contains, among the angular forms, the four-

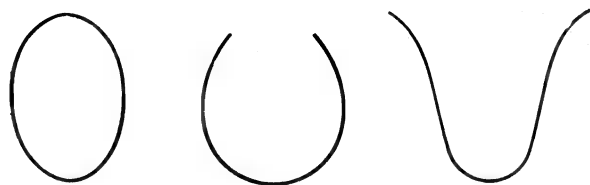


Fig. 3:35. Closed, half open, and wide open.

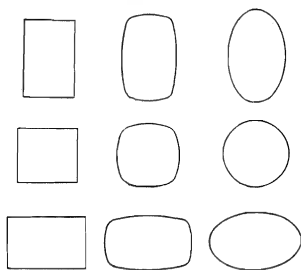


Fig. 3:36. Diagram of the attributes angular-round and proportion.

cornered ones. If we want to represent the attribute demonstrated in Fig. 3: 33, we must add a fourth dimension, as in Fig. 3: 38.

Until now we have analyzed only the plane simple forms, forms that can be drawn on a piece of paper. In everyday life, however, we always perceive visual depth; (almost) all objects are three-dimensional. An attempt to indicate diagrammatically what happens if we take this third dimension into account too has been made by Prak, see Fig. 3: 39.

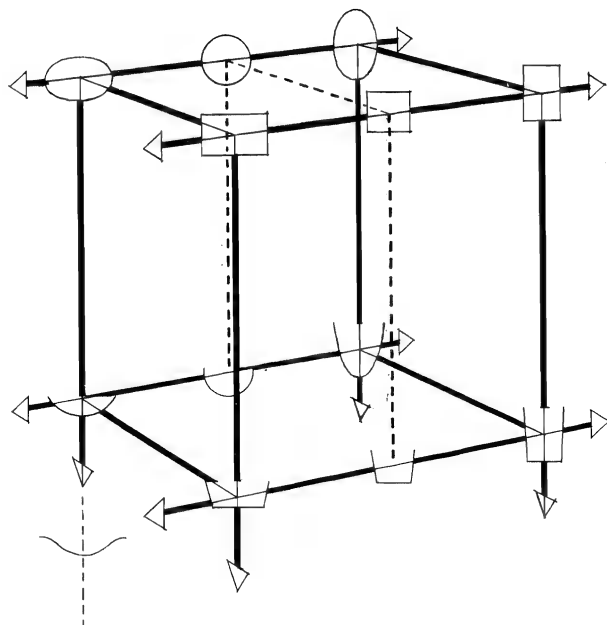


Fig. 3:37. The total diagram of the attributes of simple plane forms:

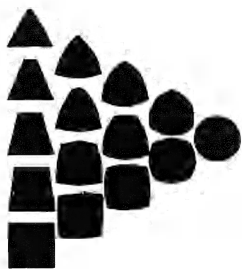


Fig. 3:38. Diagram of the attributes triangular, square, and round.
(After Hård.)

Now one word of warning must be said: diagrams like those shown here *are* not reality. They do not even *reflect* reality. What they can do for us is just help us to keep in mind some essential features of the phenomenon discussed. The phenomena are in this case the forms themselves (or the colours, or whatever it might be). After this warning about an overestimation of the diagrams I will however continue to use them as an aid to our understanding.

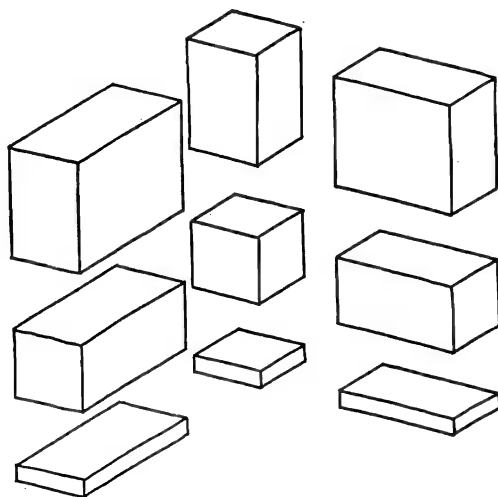


Fig. 3:39. Diagram of the proportions of a three-dimensional object. (After Prak.)

Before giving any examples of the application of the attributes of simple forms in architecture I feel it necessary to touch briefly upon another aspect of form perception, namely the *articulated* forms.

Fig. 3:40 shows, on the top, a rather simple form (though not as simple as those discussed previously). Next to it there is a form with the beginnings of *articulation*, and this to a certain extent destroys the form from which we started. At the bottom there is no longer *one* form, it has been geometrically divided into two halves. But long before this geometrical division we perceive the form not as one articulated form but as two, grown together, and it is not too difficult to detect the maximally articulated form. In everyday life we have a tendency to appreciate the articulated forms more than the simpler ones. In the history of applied Architectural Theory, however, it has not always been like that. In the thirties, for example, architects often considered that the simple forms were the only »beautiful» ones. Thus, to be »beautiful» a house should have the shape of a cube, a light fitting the shape of a globe, etc. At an exhibition in Dresden before the second world war there was even a spherical house, placed on long »legs» and supposed to be the most »beautiful» house that could be built. (I have seen it myself but unfortunately I have no photo of it and I do not know if it still exists; it might have been destroyed by the Nazis, who did not like this kind of experiment.)



Fig. 3:40. Series of forms with increasing articulation.

The question of *proportion in buildings* is something that has caught man's interest through the ages. Here I am going to take up just one aspect of this fascinating complex of problems.

EXCURSUS

The Resurrection Chapel and the Church at Klippan

The horse — like the man — knows where to put his foot, but the man is the only one who knows that he knows. I believe it was Pierre Teilhard de Chardin who underlined with these words one of the most important differences between man and animal.

So man contemplates his own thoughts, and that was how philosophy was born. For a long, long time man believed that he could master his surroundings, and even understand the true nature of all things, by mere philosophy. This philosophical thinking was especially accentuated in ancient Greece. After this it took more than a thousand years before it was understood that thought always has to be based on facts which have been obtained from observation. This systematic collection of facts, either by laboratory experiments or field observations — which we call scientific research — is something that we have been doing for just a few hundred years.

Along with the collection of data, however, the philosophical instrument has to be developed for adaptation to facts. It has also to be sharpened for a greater precision in the dissection of data. This is also true about architectural theory — the theory of how we, with our eyes and other senses, experience our man-made environment. Data-collection is in this case a part of general perception psychology. I myself have mainly been interested in how far experimental perception psychology can throw light on our architectural experiences. The philosophical instrument can however be sharpened here too and this is something to which Nordenström, a young Swedish architectural theoretician, has contributed in his »Strukturanalys, Sigurd Lewerentz' Uppståndelsekapellet på Skogskyrkogården — en arkitekturteoretisk studie». (Structural Analysis, Sigurd Lewerentz' Resurrection Chapel at the Forest Cemetery — a Study in Architectural Theory.)

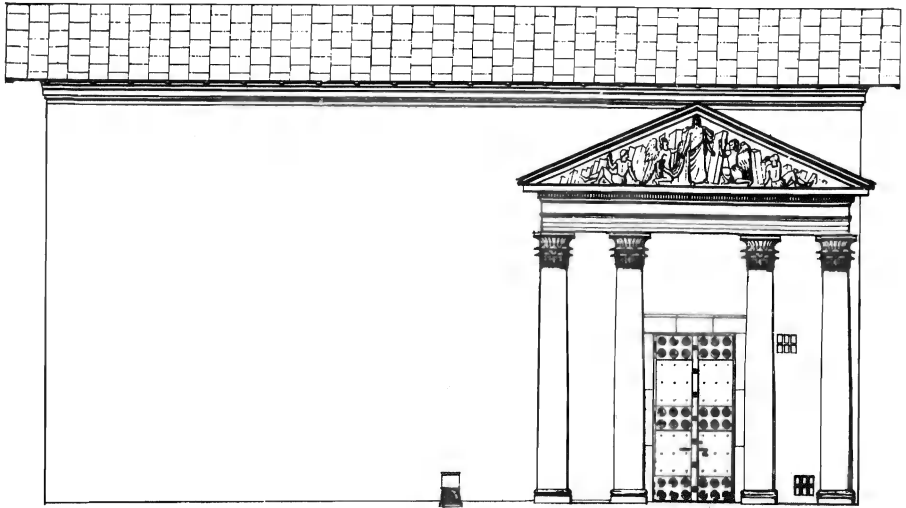


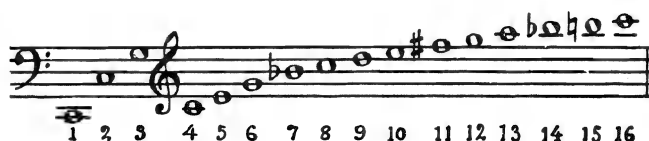
Fig. 3:41. Resurrection Chapel, drawing of exterior. Architect, Lewerentz.

I have expressed the opinion earlier that all talk about the golden section, or any other geometrical relation, as »the beautiful proportion» lacks observational support. Even if I am not alone in my opinion, especially amongst my practising colleagues, who seldom base their projects on these geometrical relations, there are examples to the contrary. Neufert devotes many pages of his »Bauordnungslehre», published in 1961, to the golden section and other geometrical relations having »magic power». To prove his opinion he refers to a number of theoreticians, amongst whom one finds Plato, Vitruvius, Leonardo da Vinci, Dürer, Zeising, Le Corbusier and many others.

Nordenström has now shown in his »Strukturanalys» that symmetry, the right angle and the golden section are structuring elements in Lewerentz' Resurrection Chapel. (Fig. 3: 41). How does this correspond with my scepticism? To solve this apparent contradiction I take to the old trick of comparing experience of form with experience of sound; but not by seeing architecture as »frozen music».

As it is known, people have sometimes stated that the pure scale is developed from the overtones of a keynote, and because its vibrations bear a simple arithmetic relation to the vibration of the keynote, the hypothesis of the beauty of these simple relations is supported. (This is for example stated by Neufert.) But the fact is that within the first 15 overtones of a keynote, for example a deep C, there is never an F. This tone, together with the fourteenth overtone B, are the most important tones in the pure scale next to the triad. However, the B flat and F sharp, which are both alien to the pure scale, appear early in the succession of overtones. (Fig. 3: 42)

Fig. 3:42. Succession of overtones.



To this one must add the fact that in the equi-tempered tuning that all instruments with a fixed tuning (tuning not affected by manner of playing) nowadays have, such as pianos and organs for example, not one interval except the octave sounds pure; a musician will notice this, though perhaps not an amateur. So we come to the conclusion that the vibrations of the strings of a piano are only rather decent approximations to the correct stimuli for the pure scale. But these approximations, which were developed during the 18th century, made possible the modulations, transpositions, and chromatic and enharmonic chords on which classical music to a great extent is founded.

Now let us transfer the reasoning outlined above to the world of visual forms. When we talk about proportions we are really talking about (at least) two different things. Partly, about proportions as the relation between parts; and partly about the proportions of a simple form, for example a rectangle or an oval. In the latter case the proportions can be recumbent, indifferent or erect.

These extremes of proportion can be estimated. Doing so, one finds that the stimulus for the indifferent square is not the geometrically perfect square; its height has to

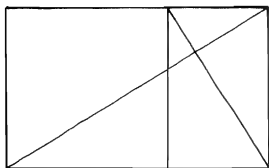


Fig. 3:43. Golden section.

be reduced by $1/7$ to $1/8$ (the exact amount being dependent on the articulation of the form). The »pregnant recumbent proportion» does not have exactly the same geometrical stimulus as the »pregnant erect proportion», but one can approximate to both geometrical values with $5/8$, i.e. the golden section. If one then also approximates to the stimulus of the indifferent square using a geometrically perfect quadrangel, one is able to make operations with these stimuli which remind one of the modulations that one achieves in music when approximating to the vibration-stimulus of the pure scale using the equi-tempered scale; recumbent golden section can be divided in such a way as to give a square and an erect golden section. This procedure may be repeated indefinitely. (Fig. 3: 43.)

With these geometrical figures one is thus able to perform operations and achieve an indefinite number of combinations of almost-indifferent-squares and almost-recumbent-(erect)-rectangles, and the directions of the shapes will always coincide with the three visual main directions. Together with the right angles formed by those main directions, and with the further addition of the perceptually important symmetry phenomenon, one is able to create a formally accentuated structured architecture; and this is what Nordenström has shown that Lewerentz has done. (Fig. 3: 44)

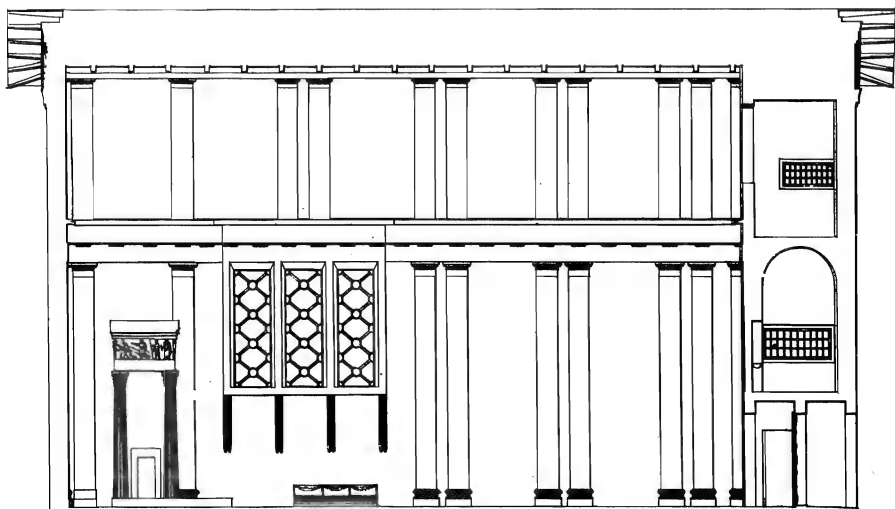


Fig. 3:44. Resurrection Chapel, drawing of interior wall.



Fig. 3:45. Church at Klippan. Architect, Lewerentz.

But of course one can within the octave make other scales than the distorted pure scale (which is not in my opinion a human invention but the discovery of a pregnancy phenomenon) and the twelve-tons-scale derived from it. Using these different scales one can compose music of what one might call an exotic character. One can also make architecture without using perfect quadrangles (cubes) or the golden section; and so on. This gives what Nordenström has called »non-formalized» architecture. Just as Lewerentz has shown an example of "formalized" architecture in the Resurrection Chapel, he has created "non-formalized" architecture in the church at Klippan. However, a closer study of these two temples shows another important difference besides the formal one.

The portico in the front of the Resurrection Chapel consists of a modified Greek temple gable. In this gable the collonade has the same relievingly »beautiful» expression of its function of carrying as in the original in ancient Greece. We can even perceive something similar in the interior, though not so much a true expression as a symbolic representation. The pilasters are not really doing the carrying; this is done by the wall. The pilasters only illustrate the wall's function of carrying. (Fig. 3:44)



Fig. 3:46. Church at Klippan, interior.

This kind of architecture has been used in »classical» styles of architecture from ancient Rome to our own time. In the church at Klippan (Fig. 3:45) there is nothing of this kind. There, every »limb» of the architectural work has its veridical expression for its function, its material and its construction; from the mighty walls, with the insulating glass cemented onto them, to the external electrical wiring. There are at the same time great formal values; the main one is the perfect visual balance.

There is no real equivalent to the architecture of the church at Klippan within the world of music. At Klippan you might experience emotional associations which could remind you in some remote way of the emotional loadings in the winding of an exotic melody, but there is in architecture something completely lacking in music, namely the triad of architectural expressions. It is true that when talking of music, one speaks of violinstrokes, trumpet-blows and flute-trills as corresponding to the expression of architectural materials, but there is no equivalent for the expression of function in architecture, because music does not serve a practical purpose in the way that architecture does. In this sense architecture means more than any other kind of art. On the other hand the superiority of music lies in its refined, nuanced and rich possibilities of emotional expression.

But just as Klippan's non-formalized architecture shows in its emotional expression a certain though remote relationship to the emotional loadings of the music of non-pure scales, the architecture of the Resurrection Chapel shows in the same way a congeniality with the equitempered tone-world of classical music, as we meet it for example in Bach's »Das wohltemperierte Klavier».

Excursus finis



For an application of the attribute *angular-rounded* I refer to the earlier description of "superellipses" and "super-circles", this being an application concerned not only with continuously curved lines but with angular-rounded forms as well.

Fig. 3:47. Landolt's ring. Concerning the attribute *closed-open* we find an interesting application in the Landolt's ring (Fig. 3: 47) used by lighting engineers for testing the »quality of lighting». It is namely so that if Landolt's ring is exposed for a very short time (in a tachistoscope) under physically weak light-radiation, the gap in the ring is not perceived. This can be expressed by saying that the attribute closedness is »stronger» than the attribute openness. When the radiant energy is increased the gap becomes visible; when this happens, lighting engineers say that there is "sufficient" light.

Gestalt Factors. In everyday life we often perceive forms that are articulated, indefinite or even blurred. The perception psychologists have been interested in finding the laws that operate when details in the visual field »come together» to build the perceived forms appearing as figures on a background. At the beginning of the century the German psychologists coined the term "Gestalts" to designate these forms, and they found a series of "Gestalt Laws" operating, of which I will take up only those that seem to be of particular interest to Architectural Theory.

The *Adjacency Factor*, demonstrated in Fig. 3: 48, makes details which are near to one another create Gestalts.

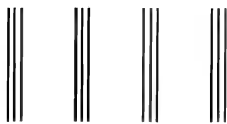


Fig. 3:48. *The Adjacency Gestalt factor.*

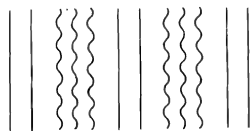


Fig. 3:49. *The Similarity factor.*

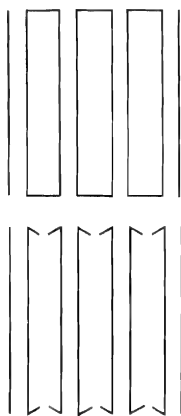


Fig. 3:50. *The Closure factor.*

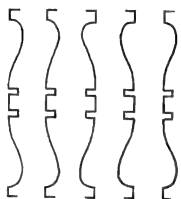


Fig. 3:51. *The Symmetry factor.*

The *Similarity Factor* is demonstrated in Fig. 3: 49. Similar details become grouped together in perception.

The *Closure Factor* makes closed contours become Gestalts; see Fig. 3:50, on the top. This is a strong factor, as already described in the discussion of Landolt's ring, and it can, even if present only as a scarcely developed closedness, overwhelm the Adjacency Factor; see Fig. 3:50, on the bottom.

Symmetry. An even stronger Gestalt Factor is Symmetry. In Fig. 3: 51 it is stronger than the Similarity Factor. Here we immediately see two symmetric forms, one being partly closed, one being more open than closed. Both the almost closed form and the non-closed one become Gestalts as the result of the Symmetry Factor.

But Symmetry is also interesting to Architectural Theory from another aspect. Formal Aesthetics deals with the problem of aesthetic appreciation of "pure" form, "pure" colour etc., without taking into account the meanings of these forms, colours, etc. (The concept of Meaning and the problem of aesthetic evaluation connected with it will be discussed later on.) A problem which has been discussed at length is whether any spontaneous and stable aesthetic evaluation of "pure" form exists. In many cases it does not, but when talking about Symmetry it does seem as if we have found something of this kind. An architect's everyday experience tells him that Symmetry is a phenomenon that is highly and spontaneously appreciated. It seems as if human beings have a strong unconscious desire to perceive Symmetry. I will give just a few examples which I will borrow from other authors.

In Fig. 3: 52 Rudofsky shows a pair of naturally grown feet. In Fig. 3: 53 is a shoe, as the customer wants it. On the left we see how this shoe distorts a naturally grown foot. On the right we see what a foot should be like in order to fit the preferred shoe. From my own experience I can witness how difficult, or almost impossible, it is to find a shoe which fits the foot. Many years ago in Sweden there was a »good» shoe on the market, but it has disappeared, because it found no buyers.



Fig. 3:52. A pair of naturally grown feet.
(After Rudofsky.)

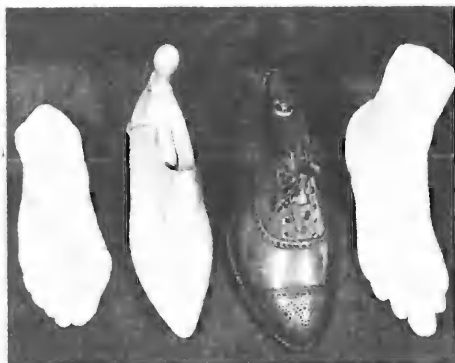


Fig. 3:53. A foot distorted by a
preferred shoe.

Fig. 3: 54, according to Malmsten, shows one quiet and one unquiet wall. In the first one symmetry has been used and here we might be allowed to say that the interior architect has used the phenomenon of symmetry in a good way.

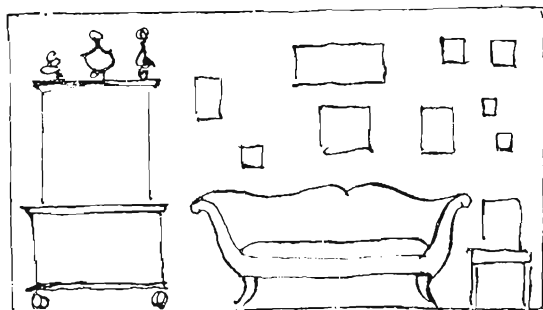
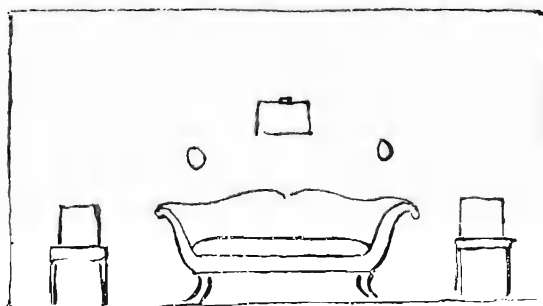


Fig. 3:54. One quiet and
one unquiet wall. (After
Malmsten.)

The same cannot be said for the building in Fig. 3: 55. Symmetry has been used here but this device of formal aesthetics stands in contradiction to the architectural meaning. On closer investigation we find namely that the mirror-image of the Music Room is actually Cloaks and Lavatories.

Between 1948–49, a project was worked out for the erection of an official building, Scântea in Bukarest. Under the influence of experts from the USSR, the projects team of architects agreed on the following declaration concerning the outlines for their planning:

»Since a number of the solutions tried — with the exception of the last one — were asymmetric, we came to the conclusion that the symmetrical solution was the one needed, a conclusion identical with the proposal upon which the central committee of the Labour Party had agreed. Every really great masterpiece in the history of architecture has been symmetrical. Even if such masterpieces as the Vatsili-Blajenyi Cathedral have many asymmetrical elements, towers, cupolas, and so on, these are corrected by the common balance.»

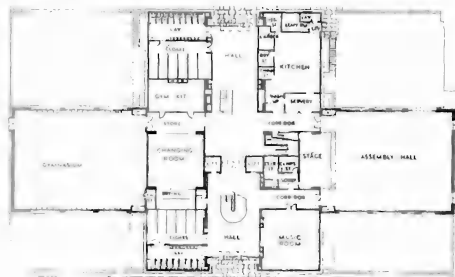


Fig. 3:55. An English school for girls.

The architects' team apparently believed that they were thus fulfilling a wish of the architecturally uneducated man in the street.

On a larger scale, symmetry has often been used to facilitate orientation. I quote from Cornell:

"The oldest Bagdad, the circular town of El-Mansur, was among the most regular ever seen. Three ring walls were placed within each other. At the four cardinal points of the compass, the main streets ended in gates. Between the main streets, spaced at equal distances, were minor streets. In the middle of the town was a square, surrounded by arcades, and here stood the palace and the mosque. Clever and skilled workers came from all around and the plan was thoroughly laid out. The town's situation on the plain permitted this extreme symmetry as it was not necessary to take the terrain or rivers into consideration as in other towns and castels."

The Factor of Meaning. When the Gestalt psychologists looked for factors acting as vehicles in the creation of Gestalts they found a remainder that could not be described in the same way as the Gestalt factors mentioned above. They called this remainder "the Experience factor", and it was described in connection with the illustration Fig. 3:56 in the following way.:

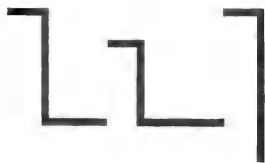


Fig. 3:56. *The Experience Factor so called.*

When we look at this illustration we see three separate bands, and that is all that we see. If we turn the figure through 90 degrees we suddenly »see« the shadow of the letter E. The Gestalt psychologists expressed this by saying that we Westerners have the *Experience* that these three black ribbons have the meaning of being a shadow of the letter E. If we make a slight change in this sentence I think we will come nearer to the truth, by saying: "We Westerners have experience that these three black ribbons have the *Meaning* of being a shadow of the letter E." It is namely the *meaning* which is the operative factor in the formation of the Gestalt. That this is the case is perhaps more evident in Fig. 3:57, this nonsensical group of spots is suddenly perceived as a unit with a meaning, and this happens without any previous experience of this illustration.



Fig. 3:57. *The Factor of Meaning.*

However, we now understand that we are no longer talking about «pure» perceptions, perceptions with no meaning. We will therefore return to this problem in chapters 14–17.

4 Colour

It is probably the realm of colour that will give us the most instructive demonstration of the difference between stimulus and perception, and of the structure of the realm of perception.

The stimulus for colour perception is not just the physical radiation entering the eye, but — as a first approximation — the selected reflectance from an object. Since the relation between the radiation falling upon the object and the reflected radiation is always the same, one could imagine that one and the same surface would always have the same colour. This, however, is not the case, and the relation between stimulus and perception is much more complicated, as will be demonstrated by some illustrations.

Fig. 4: 1 shows two arrows, one on a white background, the other on a black. The two arrows are not perceived as equal in lightness in spite of the fact that both, together with the grey frame, are printed with the same dot

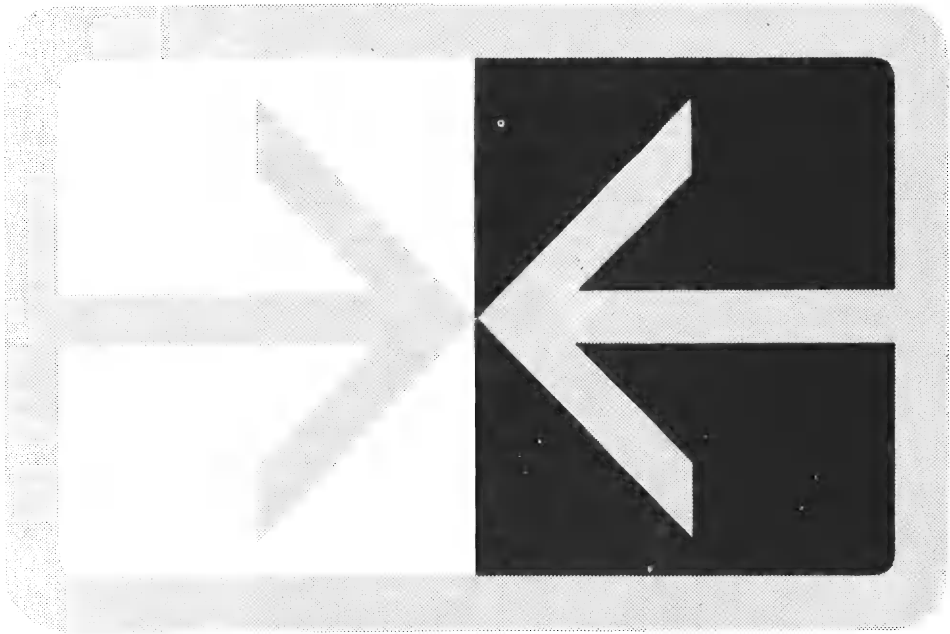


Fig. 4:1. An example of the Contrast Induction Phenomenon.

screen. The surrounding colours influence the stimulus-perception relationship of the grey arrows. This effect is called the Contrast Induction Phenomenon. But colours can even be influenced by forms; an example is given in Fig. 4: 2, »Wertheimer's Cross». The two grey triangles are not perceived as equally light in spite of the fact that they are printed with the same dot screen. Since they are both surrounded by white and black in the same way, this cannot be a result of Contrast Induction. It depends on the fact that one of the triangles destroys, or at least disturbs, the black cross, whilst the other does not. The disturbing triangle is perceived as lighter.

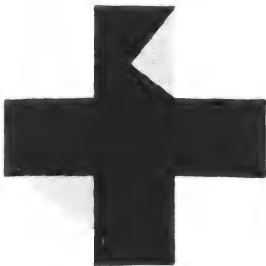


Fig. 4:2. Wertheimer's cross.

In these cases a grey colour has been changed in lightness, but chromatic colours can also change their attributes in a similar way. The only reason why this has not been demonstrated here is an economic one: this is intended to be a cheap introduction to Architectural Theory, and colour illustrations cost a lot of money. Those who are interested in going more deeply into this problem are referred to my larger book, *The Language of Architecture*. However, I hope that you have now under-

stood how important it is always to carry out any study of perception phenomenologically, in the manner described by Hering.

Attributes and Appearances. When we talk about colours as being yellow, red, and so on, we are talking about the *colour attributes*. Man has been trying for a very long time to make a systematization of these colour attributes. Among the pioneers one ought first of all to mention Leonardo da Vinci. In modern times the most important contribution has been made by Hering, and recently the Swedish Colour Centre under Hård has started experimental work based on the discoveries of these great fore-runners. I do not intend, however, to recapitulate here what I have said about the History of Colour Science in my book *The Language of Architecture*; I would refer those who are interested to that book. I will restrict myself here to a brief presentation of the NCS (Natural Colour System) as it appears today after the experimental work mentioned above.

First of all, however, it is necessary to stress the difference between colour attributes and colour appearance. When looking at an object like a red apple, for instance, we perceive the red colour as attached to the surface of the apple. This appearance of colour is called *surface colour*. When we look through a glass of red wine, we perceive the liquid volume filled with red colour. This appearance of colour is called *volume colour*. When we look at the sky, we perceive neither surface colour nor volume colour. We perceive something called *film colour*. There are also other kinds of colour appearance. We will come back to this after a description of the NCS.



Fig. 4:3. Colour sample with 10 % whiteness, 30 % blackness, 40 % yellowness, and 20 % redness.

NCS. — Hering once coined the expression Natural Colour System (NCS) for a system of classification of the colour attributes, based on phenomenological analysis. To my knowledge Leonardo da Vinci was the first person to point out that in such an analysis one will find six primary colours acting as reference points for colour perception. They are: white (Wh), black (Bl), yellow (Y), red (R), blue (B) and green (G). In recent times an experimental method has been developed at the Swedish

- a) $\frac{Y}{\quad\quad\quad} R$
- b) $\frac{R}{\quad\quad\quad} B$
- c) $\frac{B}{\quad\quad\quad} G$
- d) $\frac{G}{\quad\quad\quad} Y$

Fig. 4:4. Diagrammatic representation of the continuous change between the four chromatic primary colours.

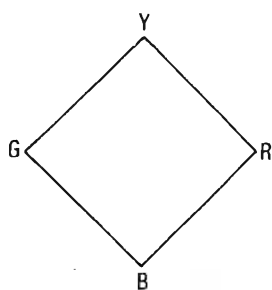


Fig. 4:5. The same as Fig. 4:4, here put together.

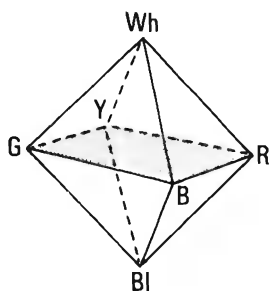


Fig. 4:6. With white and black added the diagram in Fig. 4:5 becomes three-dimensional.

Colour Centre in Stockholm under Hård's leadership. The experiments are being carried out in order to create a colour atlas that will reflect the main features of the World of Colour. (This atlas will replace my own atlas from 1954 which was the first attempt to illustrate the NCS.)

The basis for this work is the discovery that it is always possible to estimate the relation between any colour sample and the six reference points mentioned above, even when these are not present in the field of vision. Let us take an example.

When showing someone a yellow-red colour sample like that in Fig. 4:3 they can estimate more or less precisely the amount of (perceived) whiteness, blackness, yellowness and redness in the colour. This estimation may shift slightly from one person to another, but when sufficiently many subjects have made their estimations, it is possible to make a statistical analysis. In this case the mean of the estimations is very consistent; the estimations give: 10% whiteness, 30% blackness, 20% redness and 40 % yellowness.

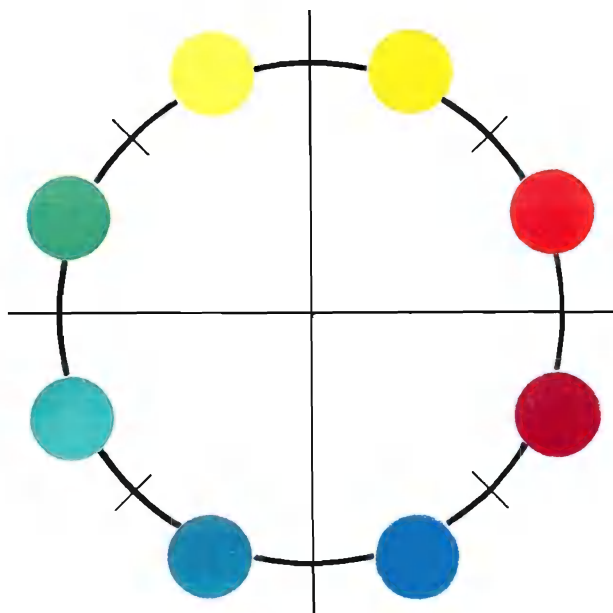


Fig. 4:7. The hue circle.

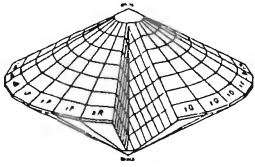


Fig. 4:8. *Ostwald's colour solid.*

When talking about attributes of visual form it was found that a diagrammatic representation can give good assistance in understanding the relationships detected. The same holds true for colour, and in fact all the researchers previously mentioned have tried to clarify the World of Colour by means of three-dimensional diagrams. As we shall very soon see, a two-dimensional diagram cannot in fact be sufficient.

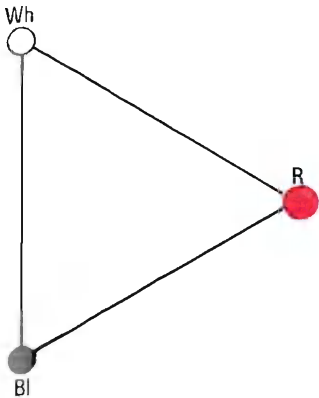


Fig. 4:9. *Triangular hue diagram.*

Let us first take into consideration the chromatic primary colours. We draw a line and write Y at one end and R at the other, see Fig. 4:4 A. Apparently this line gives a diagrammatic representation of the continuous change from a yellow colour to a red colour. R-B in Fig. 4:4 B represents the colours between red and blue; B-G in Fig. 4:4 C, the colours between blue and green; and finally G-Y in Fig. 4:4 D, the colours between green and yellow. These diagrams can be combined as in Fig. 4:5. Apparently we cannot find any place for the two non-chromatic primary colours white and black in this diagram; we have to use a third dimension as in Fig. 4:6, a three-dimensional diagram given by Dimmick and Boring. Often the square diagram in Fig. 4:5 is changed into a

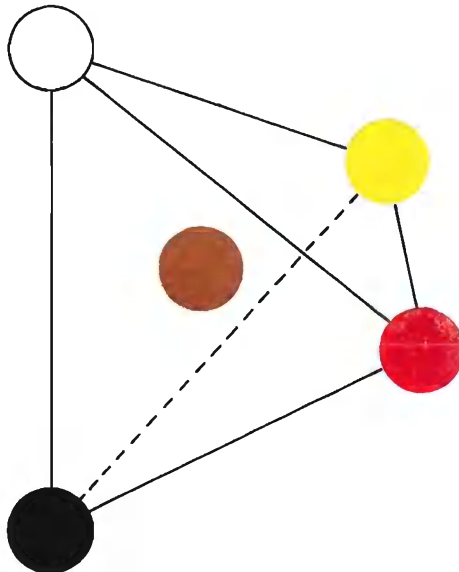


Fig. 4:10. *Any yellow-reddish colour can be placed in a three-dimensional diagram, here shown in a perspective drawing.*

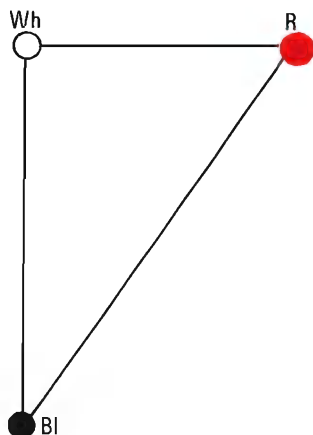


Fig. 4:11. A distorted shape of triangular hue diagram.

circle as in Fig. 4:7, the so-called *hue circle*. Some of the colours on this hue circle are shown in Fig. 4:7. In this case the colour solid that represents all colours is to be changed from the one in Fig. 4:6 to the one in Fig. 4:8, which is the one that Ostwald used for his colour atlas. In this diagram, all colours belonging to a certain hue can be represented in a triangular diagram like the one in Fig. 4:9. At one apex we find R (red), at another Wh (white), and at the third Bl (black). The line from R to Wh combines all colours that are both reddish and whiteish, but without blackness. Between R and Bl we may put all colours that are at the same time reddish and blackish but without whiteness, and between Wh and Bl all colours that are both whitish and blackish but with no trace of redness. These are the grey colours, which are non-chromatic. All colours inside the triangle have degrees of redness but neither yellowness nor blueness; they are equal in hue with the primary colour R. We can take any other colour, let us say a yellow-red colour which is 50% reddish, instead of R.

Fig. 4:12. Examples of colours in a certain triangular hue diagram.

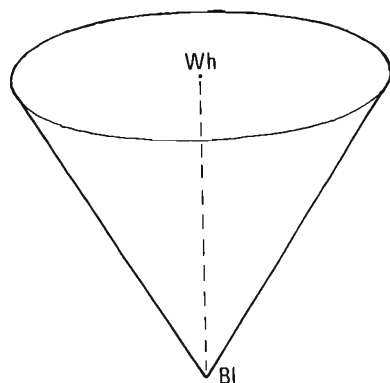
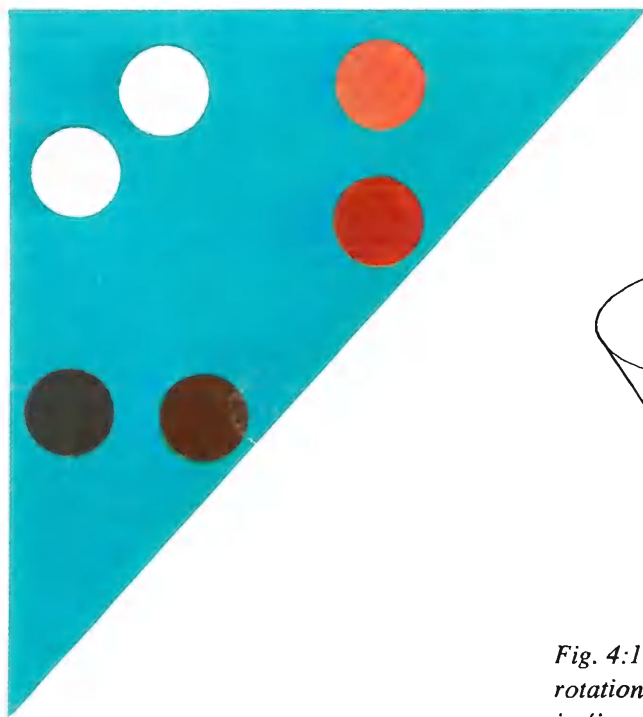


Fig. 4:13. A colour solid created by rotation of the triangular hue diagram in figure 4:11 (or 4:12).

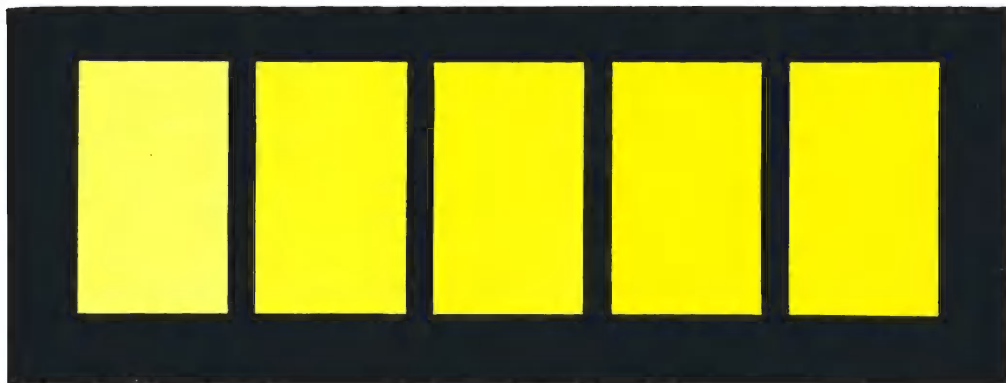


Fig. 4:14. A shift from greenish yellow to reddish yellow means a shift in colour character.

The triangle then will contain all colours that are equal in hue with this yellow-red colour, i.e. every colour within the triangle has, in addition to its whiteness and blackness, a chromatic component that is 50% yellowish and 50% reddish. Some examples of the colours within the same hue are given in Fig. 4:12.

If we now combine all the triangles of every hue (like the one in Fig. 4:11) with the hue circle in Fig. 4:7 we get a solid like the one in Fig. 4:13, containing all colours that can be imagined. I want to underline that this ordering of the colours is based purely on subjective estimations.

Primary Colours as Changing Points of Character. — In the realm of Visual Form it was found that those phenomena which act as reference points for our perception also act as changing points of character. This also holds good in the realm of colour, as the following examples will show.

Look at the five colours in Fig. 4:14. Two of them are greenish-yellow, two reddish-yellow. When the gaze is allowed to "walk" from the left to the right in this illustration, it will be found that there is a shift in character at the moment when greenishness is replaced by reddishness. This is perhaps still more evident when we concentrate our attention not on a single colour (which would be most easily done by covering four of the colour samples with a piece of white paper or card) but on a combination

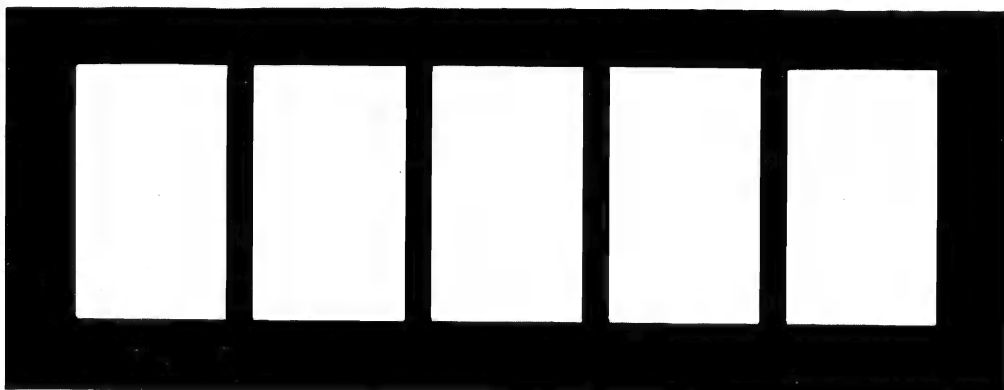


Fig. 4:15. A shift from greenish white to reddish white means another shift of character.

of two adjacent colours (which can be done by covering the other three colours with card). Let us now concentrate first on the two colours to the left, then on two in the middle, and then on the two on the right. Apparently the two colours on the left belong to each other in a certain way, and so do the two on the right. But when we look at a pair in the middle, they obviously do not belong to each other in this way; there is something about this pair that is contradictory. The same experiment can be done with the other three chromatic primary colours, and also with the two achromatic ones, Wh and Bl. Fig. 4:15 shows on the left two greenish white colours and on the right two reddish white colours. The two on the left "belong together" in a way similar to that found in Fig. 4:14, and so do the two on the right. But two in the middle do not, Wh appears here as something dividing, a change of character is detected.

The fact that the six primary colours appear as changing points of character is apparently very important to bear in mind when colouring architecture. To take just one example: when using blue for interior wall, a slight greenishness will stress the feeling of coldness that is easily connected with blue, whilst a slight reddishness in the blue will have the result that this coldness disappears, or is at least weakened. The study of an effect like this belongs, however, to the study of Emotional Loadings of Perceptions, which will be taken up later on.

Equality of Hue and Some Other Visible Relations. — I have already touched upon the fact that all colours having

the same ratio of two chromatic primary colours (like Y and R), are said to have the same hue. In the colour solid each value of this ratio corresponds to one of the triangles described above, which appear as radii when the colour solid is seen from above (or from beneath). Equality of hue has a specific aesthetic interest, since the »belonging to each other» that then appears can easily give rise to a spontaneous and strong aesthetic evaluation. Once upon a time, when I was carrying out my judgments of colour attributes for the Hesselgren Colour Atlas, the colour samples intended to demonstrate equal hue were placed on a piece of paper in a way similar to that in Fig. 4:12. The slightest deviation in hue was immediately detectable and experienced as something disturbing, something very ugly. As soon as the disturbing colour was corrected in its hue, the harmony was re-established. This phenomenon may be used in colouring architecture, but there is a danger in this. It is namely so that no paint used in architecture will be stable in colour over a long period of time. After some time — a few weeks, a few months, or even a few years — its colour will have changed. Only the most expensive pigments, which cannot be used in architecture for economic reasons, can withstand this change with time. And so it can easily happen that two adjacent colours, which in the beginning created an "equal-in-hue-harmony", can shift in different directions with respect to hue, and the harmony will be destroyed. The nearer the two colours are to each other in the hue triangle, the more sensitive we are concerning this phenomenon.

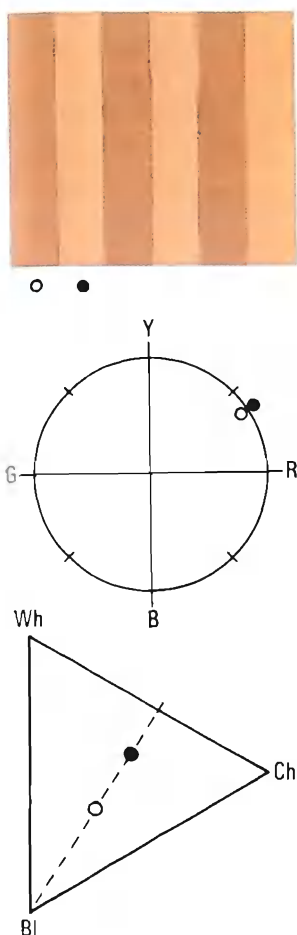
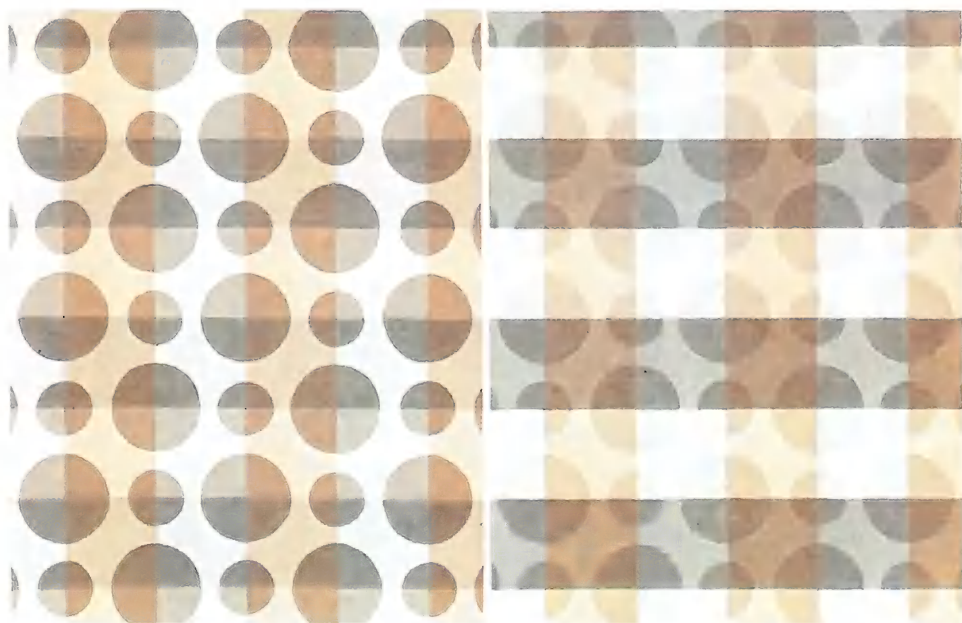


Fig. 4:16. Colours with constant ratio between two chromatic primary colours, and constant ratio between chromaticity and whiteness.

Among all colours of the same hue we might, however, find certain series where the feeling of »belonging to» each other seems stronger than it is among arbitrarily chosen colours. Look at Fig. 4:16. Here we see two colours which we experience very strongly as belonging to each other. They have the same hue; and the relation between whiteness and chromaticity is the same in all of them. Such colours are often said to have the same saturation. "Colour harmonies" of this kind may often be found useful when colouring architecture, but only if one can be sure that the relations mentioned will be stable when the colours used in painting change. It is

interesting to note that it is apparently the relation between the content of primary colours to which we are sensitive — equal hue means having a constant ratio of two chromatic primary colours, and equal saturation means having a constant ratio of white and chromaticness and not constant amount of chroma, as would for instance be displayed by colours on a line parallel to the grey axis in the colour solid. It is an open question as to whether there are other relationships which can awake the same spontaneous positive aesthetic evaluation. Experiments are needed to clarify this, experiments that could easily be carried out by anyone having a suitable colour atlas in his possession.

Differences in Lightness. — It might have struck the reader that until now I have not said a word about the lightness of colours. Apparently some colours are lighter, other darker, the lightest colour being Wh, the darkest Bl. It is also apparent that this colour attribute is something very important. Fig. 4:17 shows how a pattern can be



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Fig. 4:17. The attributes of the colours in a pattern can change the character of the pattern.

completely changed merely by changing the relation between the lightness of the colours in the composition. It is evident that the attribute of lightness has not received a clear expression in our NCS colour solid. However, some researchers (Munsell for instance) have found this attribute so important that they have based their systematisation of colours on it, and so did I in 1954 when I carried out my NCS Colour Atlas, based on subjective estimations of hue, saturation and lightness. The workers at the Swedish Colour Centre have, however, found that equality of lightness — which is the mean that must be used if one wants to base a colour systematisation on the concept of lightness — is rather difficult to define phenomenologically, and more difficult to estimate than the amount of the four of the six primary colours that occur in a given colour. However, I cannot go more deeply into this complex of problems here, since this is only meant to be a brief survey. Those interested are referred to the NCS Colour Atlas and to the manual attached to it.

Large Interval Out-of-Doors. — When colouring exterior architecture one soon finds that small differences in colour which are often evaluated as "delicate" in indoor colouring, may often be found outside to be "dull". According to my own experience it seems that one can only put in one colour between two primary colours, and the best result is often achieved when setting only colours as near to the primary colours as possible. A red building with white trim and black ironwork: how fresh and clean it appears! In particular something white in the colour combination seems most often to be valuable. But of course this is not an inflexible recipe for a good result, one must always treat each colouring problem separately, using one's imagination and sensitivity.

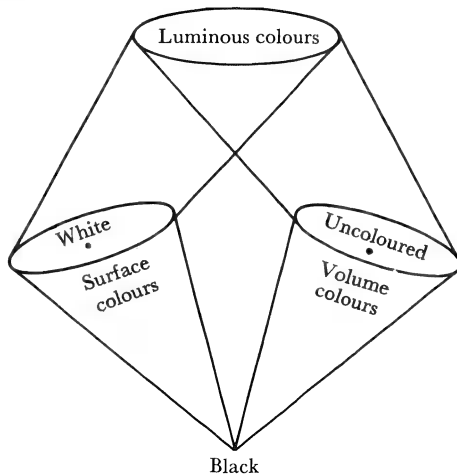
Chromatic Character of a Pattern. — Fig. 4:17 illustrates how the attributes of the colours in a pattern can change the character of the pattern.

Colour Appearances. — Katz, who is one of the most outstanding phenomenologists, has devoted years of research to the Colour Appearances that I previously mentioned briefly. The Colour Appearances mentioned

were surface colour, volume colour and film colour. Besides these, lustre, sparkle and gloss can be said to be intermediate links between Colour and Light Perception, as will be understood when we discuss the phenomena within Light Perception. In close connection with these is the appearance of the luminous colours, such as those we perceive when looking at traffic lights, chinese lanterns, and other coloured light sources. These colours can be strong or weak, more or less whitish and at the same time less or more chromatic, but they can never be blackish. Thus it is possible to make a diagrammatic representation of the luminous colours on a two-dimensional surface, for instance on a circle, with the chromatic extremes along the periphery and white in the centre. In Architectural Theory Luminous Colours are of more interest than Film Colours and it might be of some interest to investigate the possibility of making a diagrammatic representation that includes the three most important colour appearances as well as the colour attributes.

It is possible to change a surface colour into a volume colour continuously. We can for example make the following experiment: when we fill a glass with milk, the white colour we see is a surface colour. If we gradually pour more and more water into the milk (and at the same time take away some milk to avoid overflowing), it will

Fig. 4:18. Using the colour solid shown in Fig. 4:13 one can demonstrate the most important colour appearances in a five-dimensional diagram like this one.



become more and more transparent and its colour will gradually become more like a volume colour. When we have come to the point where all the milk has disappeared and only water is left, the content of the glass has become fully transparent. The extremes are thus white — colourless. From a phenomenological point of view this is surprising, since a fully transparent chromatic object — for instance a glass of red wine — is still chromatic. And black is always black and can never become transparent. These facts, together with what has been said about the character of the luminous colours, can be demonstrated in a five-dimensional graph like the one in Fig. 4:18.

Talking about aesthetic evaluations, it is a well known fact used by everyone who wants to create a festive effect that the luminous colours of chinese lanterns and glowing objects like an open fire always are appreciated. Among the surface colours we find some that resemble the luminous colours, namely the brilliant colours (colours with no black-content) which are placed at the upper surface of the colour solid. They are in everyday language often called »beautiful» in contrast to the ones with more or less blackishness, which are often called »dirty».

Preference Investigations. — Concerning the aesthetic evaluation of different hues, a huge amount of preference experiments with isolated colours have been carried out. They all show the same result: blue is always the most preferred colour in this case. How can it be, then, that not all the buildings in a town get painted blue? The answer is first of all that we never perceive the colour of a building as an isolated colour, there are always other colours present in the visual field, very often the blue of the sky and the green of the verdure. Experiments with colour combinations have shown that the yellow-red (orange) hues are easier to combine with these and other hues if we want a result which will be widely preferred. And then there may be another reason too; in everyday life we never perceive »pure sensations», they are always the bearers of meanings, and the aesthetic evaluations of architectural expressions (that I have called architectural evaluations) over-ride the aesthetic evaluation of »pure sensation» (that I, in accordance with the art theorists, call formal aesthetics). The problem of architectural evaluation will, however, be taken up later on.

5 Light

Stimulus and Perception Once Again. — Fig. 5: 1 demonstrates what happens when a physical body of a certain kind (a so-called »black body») is heated; it emits physical energy in the form of radiation. If it is only heated to 500 degrees K (degrees Kelvin, counted from the physical absolute zero of temperature), the amount of energy emitted is rather small; it has a maximum at a characteristic wavelength. When it is heated to 2 000 degrees K the maximum occurs at a shorter wavelength and the total range of radiation is wider; part of it is the stimulus for visual perceptions, called in the illustration the "visible region". This name is of course somewhat misleading, since it is not the wavelengths that we see. We see forms, colours, and light. The technologists talk about "light" as if it was merely this realm of physical radiation, measurable by means of physical instruments. In everyday life, however, the concept of »light» is something quite different. When I say that now, in January 1970, it is probably lighter in Buenos Aires than here in Sigtuna where I am writing this, I am talking of what we *see*, I am talking about a certain kind of perception. And it is this perception that we are now going to examine with the phenomenological method.

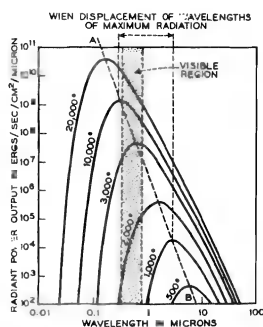


Fig. 5:1. Diagrammatic representation of energy radiation, stimulus for visual sensations.

Colour Sensation and Perception of Light. — When we perceive a coloured object we experience the colour as attached to the object, the colour is perceptually belonging to the object. When we see that the object has been placed in bright light or dark shadow, this is something that does not belong to the object itself; the light (or the shadow) is instead something which falls upon or covers the object.

Attributes of Light Perception. — The light falling upon an object can be either bright or dim or something in between these two extremes. It can also be perceived as being warm (yellowish) or cold (bluish), and it can be monotonously spread out in space or it can be so unevenly distributed that it is glaring. Fig. 5: 2 tries to demonstrate these attributes of light perception in a diagrammatic representation. We will now discuss them briefly one by one taking the aspect of aesthetic evaluation in account as well.

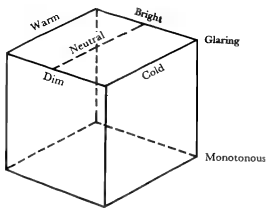


Fig. 5:2. Diagrammatic representation of the attributes of the sensation of light.

Lightness and Darkness. — Apparently we do not appreciate a monotonous distribution of light. Monotony is always tiring. We all know how happy we feel when, roving in a hilly landscape, we see the glimpses of sunshine and the shadows of clouds moving over the hills. In this case, however, it is not only the attributes of »pure» light perception that we appreciate, it is — perhaps even more — the meaning of these attributes: as I said, glimpses of sunshine, shadows of clouds. This also holds good for an interior lit by daylight. When we see sunshine coming in through the windows we feel happy, when the light source is the monotonous light from an overcast sky we tend to feel sad. But even apart from this aspect, we like an uneven light distribution better than a monotonous one. This must not, however, lead us to the assumption that the light distribution can be unlimitedly uneven. The psychologists talk about optimal complexity in problems of this kind, but what this may mean in application to light perception has not been studied scientifically. Here we architects have to rely on our intuition and on the method of trial-and-error.

Glare. — The problem of glare can in itself be tackled phenomenologically. Glare can be defined by means of a very simple experiment. When there is a light source in the field of vision, which is suspected of giving rise to glare, perhaps a window in a daylight room or an artificial light source, do as follows: put your hand in front of you as a protection, so that you can no longer see the light source; if you then suddenly see the rest of the objects in your field of vision much more clearly, as if a veil had been taken away, then the light source was giving rise to glare. Glare is classified by Hopkinson as follows:

The glare is
just perceptible
just acceptable
just uncomfortable
just intolerable

and it may be that just acceptable glare aroused by sparkle and glitter is often highly appreciated, especially when we are in a festive mood rather than working. This gives an example how our preference can depend on our attitude.

Colour of Light and Colour Rendering. — The light from an open fire is apparently much »warmer» than the light from the moon, and sunshine is »warmer» than the light from an overcast sky. We usually assume that one could describe or define this »warmth» by a physical description of the physical radiation. The connection between perception and stimulus is, however, rather complicated, and a description of the properties of the physical radiation does not as a rule tell us anything about the character of the perception. I do not intend to go into this problem here; those who are interested are referred to my book *The Language of Architecture*. It suffices here to draw attention to the phenomenon and to say a few words about the spontaneous aesthetic evaluation of this attribute of the perception of light.

We tend namely to appreciate warm light more than cold, in most cases. This is more apparent when the light we are perceiving has a low intensity and when we are in a relaxed mood. Think, to take an example, of the situation when we are sitting around an open fire at a barbecue when camping, relaxing after a tiring day's walk in the woods. On the other hand, however, we may appreciate the cool »sober» light from fluorescent lamps when we are working.

A shift in the distribution of wavelengths in the incident physical radiation can sometimes give rise to a shift in the colours of the objects around us. We talk about the radiation's properties of colour rendering. This problem is connected with the problem of the physical stimulus for light of a perceived colour. However, the perceived colour of the light does not immediately tell us about the colour rendering properties of its physical stimulus; it is not so easy. Two sources of light can, for example, give light of the same perceived colour but have quite different colour rendering properties, which means that one and the same object can be differently coloured in the two kinds of radiation. The problem of colour rendering has been tackled by the people at CIE (Commission Internationale de l'Eclairage) but up till now without success. That means, we are still not able to predict the colour rendering even when we know the distribution curve of the radiation from a light source.



Shadow. — The saying that the most important attribute of light perception is shadow has a lot of truth in it. The shadow is first of all one of the factors that operates when we perceive visual depth. Look at Fig. 5: 3. In the two photos at the top of this illustration we can clearly see the shape of the ball and how it is situated in relation to the wall and floor, and it is the shadow that tells us about this. In the two photos at the bottom the situation is quite different, and here the shadow does not give any proper information about the location of the ball. The fact that shadows can help us to perceive visual depth also means, as we all know, that shadows can make an object more plastic ("modelling"). We usually tend to appreciate this modelling by shadows.

The problem of this modelling by means of shadows and its stimulus — the distribution of the physical radiation — has been studied by many researchers, from Leonardo da Vinci to the researchers at modern lighting laboratories. One and a half decades ago Waldram described what we might call a pilot study carried out at General Electric's lighting laboratory in Great Britain. Lynes has recently published a series of experiments carried out at Pilkington's laboratory, again in Great Britain.

The result of these experiments can be briefly summarized by saying that the stimulus for this modelling by shadows is best described as the ratio between the radiation at the highlight and the sum of the total radiation from all directions to the object. This ratio must be kept within certain limits. The graduated shading in the semi-shadow between the highlight and the full shadow is also of greatest importance.

From the phenomenological point of view there is perhaps no-one who has given such a clear description of shadow and what it can do for us than Henningsen, the late Danish architect, from whom I quote:

»Electric light has given people an entirely erroneous idea of the value of shadow. Today it is almost regarded as an enemy; but any defects that shadow may have do not originate in shadow itself. They always depend upon the light. If the shadow is hard and sharp it is because the

Fig. 5:3. With suitable shading we can determine the position of the ball. (After Pleijel.)

light is hard and sharp. As a simple consequence of technical advance we have completely indirect lighting and wall light which give shadowless light. While an incandescent lamp without a fitting gives hard shadows and dazzles, one can, by illuminating the whole ceiling, have light that is free from glare and shadow; but one cannot live in this light. It turns the room into an aquarium, at the bottom of which one lives. It is also by its nature not picturesque. Hard lighting can be used in a wood-cut illustration, but one can neither depict the shadow-less room nor apprehend the objects it contains. Naive people in their simplicity are impressed by shadowless light as an achievement of technical art, but actually there is no art in producing such light. One can illuminate an elephant so that it casts no shadow provided that the light fittings are made a sufficient number of times larger than the elephant. When glare is avoided and the scale of the lighting in a room is correct the shadow will also be beautiful, a help while working, and a means of realizing the form of the room.

»There are four types of shadow. The *large shadow* gives the room character and form and cannot be dispensed with. It is the shadow from furniture and the large articles in the room. This is lacking in shadow-less light and makes the indirectly lit room unplastic. The *half-shadow* occurs in the transition between a shadow and a lighted surface. It makes the transition soft and prevents over-hard contrasts. Naturally the half-shadow does not occur in indirect lighting; but nor does it occur in sharp, direct light. It appears only when the light comes from a fitting of suitable diameter. The *hand-shadow* is the shadow of one's hand moving over the table while working. This is also absent in shadowless light which is an advantage. In sharp light it becomes hard and has an irritating effect but it is absent in light from fittings with suitable diameter.

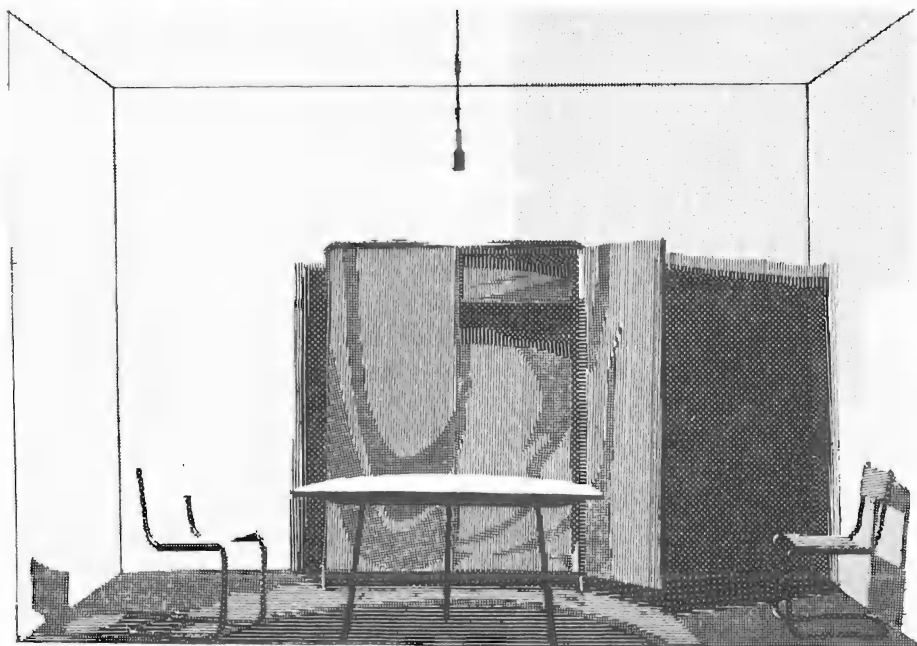
»Finally, there is also the *small shadow* which appears every time the needle meets the cloth and the pen meets the paper. It is of practical use as it helps one to judge small distances correctly. Everyone can confirm that as the nib meets its shadow it simultaneously touches the paper. In shadowless light (where the small shadow is absent) the firm surface of the paper changes to some-

thing indefinite which one has to search for. It is, therefore, a question of designing fittings so that the *large* and *small* shadows and the *half-shadow* are retained but the *hand-shadow* is avoided.

»In the case of direct light from an unshaded incandescent lamp one has over-hard large shadows with no half-shadow, unpleasant hand-shadows, and a hard small shadow. With indirect lighting one has no large shadows or half-shadow, no hand-shadow, and no small shadow. If one uses a correctly designed fitting which is not open below and which is free from glare in all directions (30 to 60 cm in diameter) one has large shadows with suitable half-shadows, no hand-shadow, and a distinct small shadow.

»In order to explain these remarks in more detail we might add the following. Large shadows appear when the fitting is considerably smaller — seen in perspective — than the furniture and other articles which one wants to cast shadows. The half-shadow appears when the fitting is not too small. The hand-shadow vanishes when the fitting — seen in perspective — is considerably larger than

Fig. 5:4. Henningsen's model room.



the hand and the tool. By the perspective comparison we simply mean that the diameter may be less when the fitting hangs low than when it is high. Finally, the small shadow appears when the distance between the tool (pencil, needle, etc.) and the plane on which the shadow falls is small, provided that the fitting is not too large. The result of all these conditions for correct shadows is . . . that the fitting in a normal room should be not less than 20 cm and not more than 80 cm in diameter. Within this range one also gets the half-shadow which is so important for the nuances of the brightness scale (distribution of luminances, to use the technical term — author's note), comfort with lighting, and appreciation of the artistic values.»

The illustration shown in Fig. 5: 4 depicts what Henning-sen regarded as a correct distribution of shadow and illumination in a room. The fitting is the famous PH- lamp, now about 40 years old. This design is at Luis Poulsen and Co. AS. (Lamp fittings), Copenhagen with whom he cooperated.

6 Texture

The surface of an object is not usually absolutely smooth; small unevennesses can be detected. Even the paper used in this book shows small, just perceptible unevennesses. Such small unevennesses are commonly dealt with under the heading »texture». The texture can be regular or irregular, small or large, rough or smooth. It can be perceived as visual texture when the visual sense is operating, or tactile texture when it is experienced by means of touch. In my book *The Language of Architecture* I have referred to tactile texture as grain, to make a clear distinction between this and the visual perception. A large, regular texture might be called pattern, but many researchers do not make any clear distinction between texture and pattern. Thus Gibson, who has studied this problem experimentally, talks about what he calls »texture gradients», examples of which are shown in Fig. 6: 1 and 2. In this case we see some lines, which together define a pattern in perspective. In Fig. 6: 1 this pattern gradient gives rise to an edge, in Fig. 6: 2 to a corner. The illustrations may be looked upon as a schematic representation of something that can in fact be varied in uncountable ways. Texture and pattern gradients form a specific

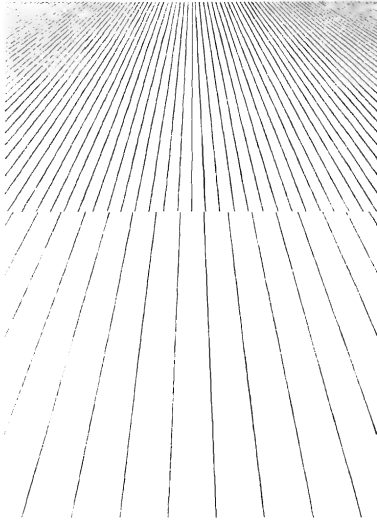


Fig. 6:1. The "texture gradient" tells us about edge . . .

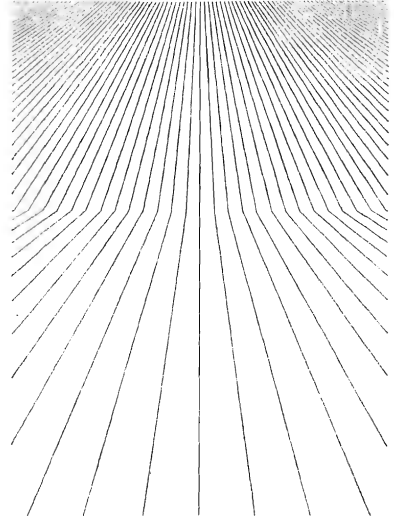


Fig. 6:2. . . and corner. (After Gibson.)

variant of one of the "secondary factors" of visual depth dealt with in chapter 3, Visual form, namely, "size and perspective". They are also important in other respects, especially as the bearers of the expression of material. This, however, will be dealt with later.

7 Tactile Surface

Until now we have dealt with visual perceptions, because these are the most important ones in discussions of man's perception of his man-made environment. But other kinds of senses are also operating here. Since they are of less importance, however, it is possible to deal with them more briefly.

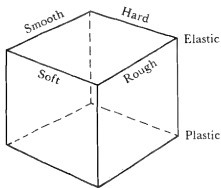


Fig. 7:1. Diagrammatic representation of the most important tactile attributes.

When we touch a surface with our fingertips (or some other part of our body) we get the experiences that we call tactile perceptions. Just touching is, however, not sufficient; we must also move our fingertips about in order to be able to perceive all the tactile attributes. Thus we feel whether the surface is hard or soft, smooth or rough, elastic or plastic, warm or cold. Four pairs of extremes implies four dimensions in a diagrammatic representation. Fig. 7: 1 shows how three of them can be placed into an ordinary three-dimensional coordinate sys-

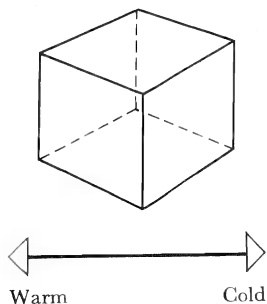


Fig. 7:2. The total diagram of the tactile attributes.

tem, a cube. If we want to represent the fourth dimension it can be done by moving this cube along the temperature axis, as shown in Fig. 7: 2.

When talking about the dimension of temperature there is one important fact to be noticed. The temperature dimension has not just two extremes, it has three forming a linear sequence. Between warm and cold we namely perceive a zero point where we have no feeling of temperature whatsoever. This point is often called the physiological zero-point, but since it is a question of perception I prefer the term psychological zero-point. The stimulus for this can vary; most often it is about 28–29 degrees Celsius, but by »re-attuning» the physiological registration apparatus, it is possible to obtain the same sensation from quite different stimuli or even different sensations from the same stimuli, as this simple experiment will show. Keep one hand in a bowl of water at 25 degrees C and the other in water at 35 degrees C for 10 to 20 seconds, then dip both hands in water at 30 degrees C. The left hand will register a sensation of warmth, the right hand one of cold. This may be expressed by stating that the stimulus for this pregnancy phenomenon, the psychological zero-point, has been displaced in different directions for the left and right hands.

The study of the aesthetic evaluation of tactile perceptions is somewhat neglected in Western culture. The Japanese, however, have always drawn attention to this, and we Westerners have quite a lot to learn from them. Our special interest, however, will be in studying the effect of the transformation tendency, which means in this case that tactile conceptions can be awakened by perceptions in other realms of perception. We will come back to this in a later chapter.

8 Haptic Form

When touching an object, we do not only have tactile perceptions. We often have an experience of the form of the object at the same time; we have haptic form perceptions. Haptic form is not quite the same as visual form, even if there are some similar structuring phenomena in the two realms. Thus the two main directions up-and-down and sideways exist even in the realm of haptic

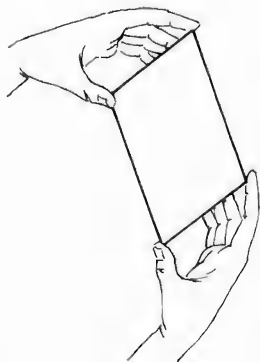


Fig. 8:1. How to perceive haptic proportions.

form. We can also perceive haptic proportion, for instance in the way shown in Fig. 8: 1. With the hands stationary, the thumbs and forefingers can have a haptic perception of proportion, but most often the hand(s) must be moving to give a full haptic perception. There is, however, one very important dissimilarity in these two realms of form perception which is illustrated in Fig. 8: 2 and 3.

Fig. 8: 2 shows a sculpture, a »self-portrait« made by a blind sculptor who has been blind from birth. The features are very expressive, but they are only loosely added to each other, they remain isolated. This depends on the fact that a blind person's haptic perception is something that is experienced successively, part by part. In contrary a visual form is perceived simultaneously, "at one glance". Fig. 8:3 is a "self-portrait" made by a visually-minded blind sculptor who had became blind later in life. She had once been able to see and now that she is blind she tries to get visual images from her haptic form perceptions; she has in a manner of speaking sculptured in her visual imagination. Thus her sculpture has a quite different character from that of her blind-from-birth

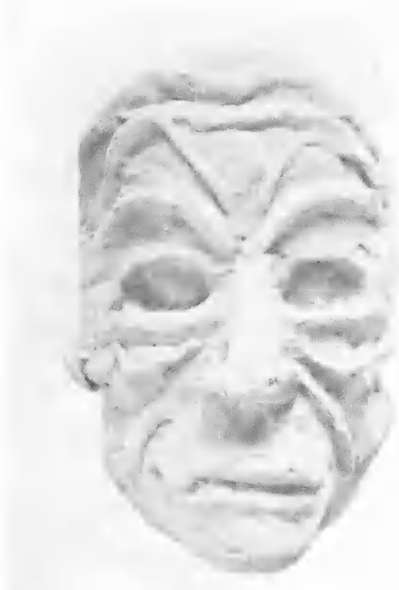


Fig. 8:2. Self-portrait by haptically minded blind sculptor. (After Lowenfeld.)



Fig. 8:3 Self-portrait by visually minded blind sculptor. (After Lowenfeld.)

sister. The face that she has made appears as an articulated unit.

It is an interesting and important fact that a person who once has been able to see has a tendency to transform his haptic perception into visual image or conception. We will come back to this later.

9 Kinesthetic Perception

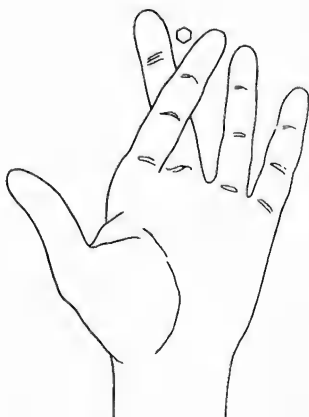


Fig. 9:1. Aristotle's experiment.

By kinesthetic perception we mean the impressions that we receive from our own body. We can feel whether we are standing, sitting, lying or moving, and we feel how we are moving. We also feel how our limbs are situated in relation to each other. But we can sometimes make mistakes even in this. Try for instance Aristotle's experiment, demonstrated in Fig. 9: 1! A pencil moved between two crossed fingers is often perceived as two pencils instead of one.



*Fig. 9:2. Play sculpture.
Designer, Møller-Nielsen.*

The kinesthetic perceptions are of course important for our orientation in the physical world, but they can in themselves also be highly aesthetically evaluated. Fig. 9: 2 gives an example, a »play-sculpture«, intended to be perceived not only visually but also as tactile surface, haptic form and kinesthetic motion.

On a much greater scale, we can talk about the kinesthetic experience of landscape when driving through it in a car.

10 Auditory Perceptions

The auditory perceptions are usually studied under the sub-headings musical tone, noise, and speech sound. Musical tone and speech sound are not very important in Architectural Theory, even if some comparison between proportions in visual form and the musical pure scale can be of some interest, as I touched on in a previous chapter (3, Visual Form, excursus on the proportioning of the Resurrection Chapel).

Noise is nowadays being studied as something disturbing that should be avoided. Here, however, I want to stress the importance of studying not only how to get rid of disturbing perceptions, but also how to achieve stimulating ones. In such a study one finds two interesting auditory phenomena. The first one is the phenomenon of reverberation, which should not be confused with the phenomenon of echo. Echo means that a sound is repeated, usually from another direction than that from which the primary sound came. Reverberation means that after the primary sound has ceased the same sound is heard, decreasing, from all directions, for example from all parts of the room in which one is. It has been found that there ought always to be a certain relation between the visually perceived room and this »auditory room« if a good impression of the room is to be achieved.

Fig. 10: 1 shows this preferred relation between reverberation and physical volume of the room in the form of a graph.

The other interesting fact is related to this. It deals with the contribution of the auditory perception to the total perception of the room. For instance, is it so that the first

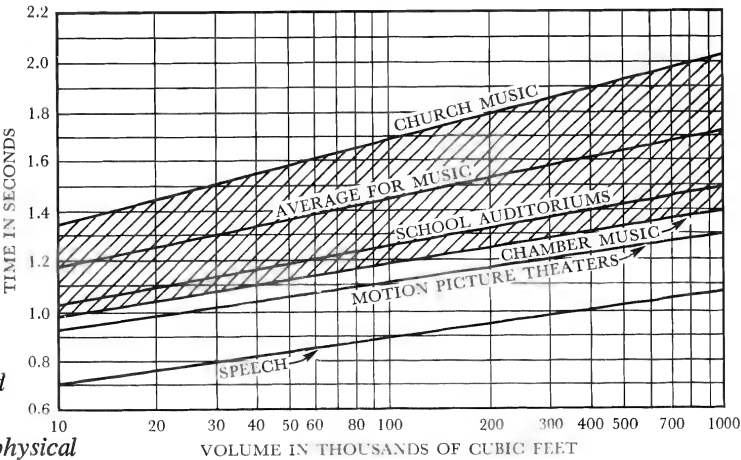


Fig. 10:1. Preferred relation between reverberation and physical volume of the room. (After Knudsen & Harris.)

reflections of the air waves, which are the stimuli for the auditory perceptions, against walls, ceiling, and floor, which come so close to the primary sound that they cannot give rise a perception of reverberation, can act as stimulus for a perception of what might be called an "auditory space"? This is, however, only a hypothesis which has not been experimentally confirmed.

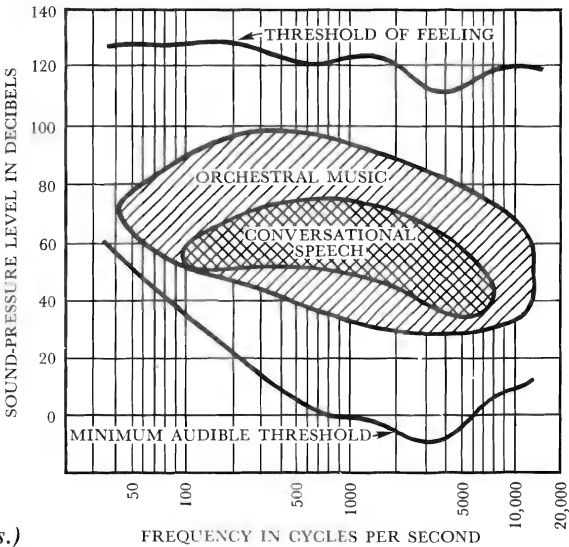


Fig. 10:2. Stimulus for auditory perceptions. (After Knudsen & Harris.)

Concerning the relation between stimulus and auditory perception I refer to Fig. 10: 2, a diagrammatic representation of those realms of air-oscillation which can be stimulus for different auditory perceptions.

11 Other Perception Modalities

Other perceptions than those described up till now are also functioning in Man's Perception of Man-made Environment. However, it will be sufficient here just to mention that perceptions of taste and smell can be diagrammatically represented, as Fig. 11: 1 and 2 show. Fig. 11: 1 is the Taste Tetrahedron, Fig. 11: 2 is the Smell Prism, both according to Henning. It might, however, be mentioned that the Smell Prism in particular is very much called in question by the perception psychologists.

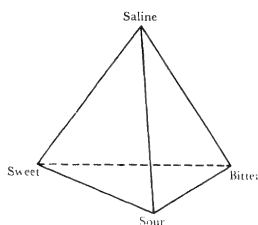


Fig. 11:1. Henning's taste tetrahedron.

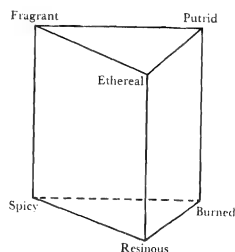


Fig. 11:2. Henning's smell prism.

12 Movement and Time

There are some perceptions that are not bound to particular sense organs. Motion can be perceived both visually, auditorily, tactily, and kinesthetically. Important in itself, it is of the highest interest to Architectural Theory as a necessary condition for the transformation of visual perceptions to conceptions of motion.

Experience of time is closely connected with perception and conception of motion. Experienced time is not the same as objective, physical time. Its character can best be described by means of a diagram like that in Fig. 12: 1. Here the perceived »now» is depicted in the middle of the diagram. »Backwards», this »now» is more and more »mixed with memory», »forewards» it is more and more »mixed with anticipation». A piece of music is perhaps the

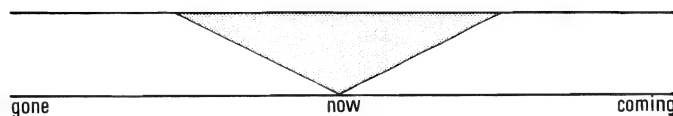


Fig. 12:1. Diagrammatic representation of the attributes of subjective time.

best example to clarify this. When listening to the melody one is not only remembering the tones that have passed, but the total melody is perceived as something going on »now», although this »now» is weaker in both directions, both the gone and the coming. Experiments have shown that the stimulus for the perception of this »mixed now» can vary from about 0,001 seconds to about 4 seconds (and from everyday experience even more).

13 Transformation Tendency and Rhythm

Look at Fig. 13: 1. If this were reality and not a picture, we would have seen the ascending smoke as something in motion; we would have perceived motion. In the picture the smoke is not moving, it is static, but despite this we can imagine the smoke as something moving, we have an image or conception of motion. In this case the perception of a static form has a tendency to be transformed into a conception of motion.

Now look at Fig. 13: 2, a static sculpture. We can move ourselves around this sculpture but it will remain static. In spite of this we have a feeling, or conception, of rhythmical motion when we let our glance follow the contour lines and the boundary surfaces. In this case the conception of motion has a character of »rhythm», something that is difficult to describe or define but is easily observed as a part of our conception experience. The fact that visual perceptions can have a rhythmic character is of utmost importance to Architectural Theory. Fig. 13: 3 gives an example of this. It is a well known and widely admired Swedish house in which the windows are inserted according to a rhythm that is rather free.

This Transformation Tendency however, can also appear in a rather different way. Fig. 13: 4 shows two horses at a gate. Looking at the stone gate-post we get a conception



*Fig. 13:1. Ascending smoke
in rhythmical motion.
(After Bill.)*



Fig. 13:2. Sculpture by Bill.

Fig. 13:3. House. Architect, Asplund.

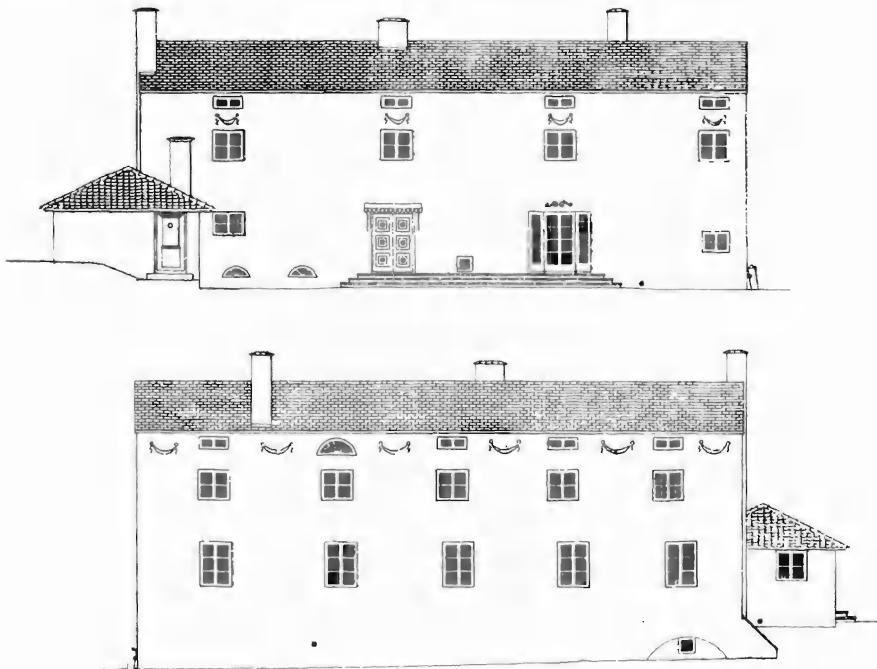




Fig. 13:4. Visual texture perception gives rise to tactile conception. Photo by Tysklind.

of coldness, hardness, and roughness; looking at the nose of the horse we get a conception of something soft, warm, and smooth, we »feel« how it would be to caress this silky nose. Experiences of this kind apparently play a big role in perception in general and the perception of man-made environment in particular.

III ARCHITECTURAL EXPRESSION

14 The Concept of Meaning

Meaning and Experience. — Let me first refer to Fig. 3: 56 and 3: 57, and to what we said about these illustrations in Chapter 3, Visual Form, under the sub-heading The Factor of Meaning. We had at that time already begun an investigation of the concept of Meaning. We had also realised that the experience of a Meaning is a factor of great importance within the total perceptual process.

The Spontaneous Meaning. — Meaning is something that we add to a perception spontaneously. Before beginning to study in which way meanings can be attached to

Fig. 14:1. Perception of a nonsensical form gives rise to meanings in memory. (After Gibson.)

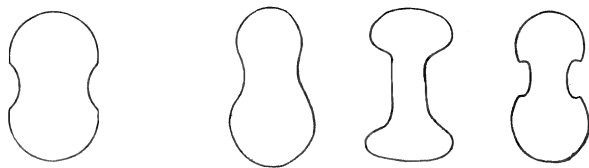


Fig. 14:2. Meaning constitutes the figure. (After Woodworth.)

perceptions, let us look at some convincing examples of spontaneously experienced meanings. Fig. 14: 1 shows an experiment once carried out by Gibson, the famous perception psychologist. He showed his subjects the nonsensical form on the left and afterwards he asked these subjects what they had seen. Some of them said they had seen a female torso, some of them a dumb-bell, some a violin, implying that they had attached one meaning or another to the form. Fig. 14: 2, due to Woodworth, shows how meaning may constitute the relation between figure and background. The part of the picture to which the meaning of a face is given is perceived as figure, and the other part becomes background. The reversal occurs suddenly, and can only to a limited extent be influenced by will.

Fig. 14: 3 (after Fisher) shows a series of drawings. No. 1 in this illustration is something that is usually experienced as having the meaning of a man's face. No. 15 is usually experienced to have the meaning of a young girl. As you move your gaze along the series from one drawing to another, the meaning of a man's face is gradually weakened and the »girl-meaning» begins.

At a point somewhere in the middle of the series the spontaneous switch-over in your experience will take place. The exact point of the switch-over may be slightly different for different subjects, but the main point which I want to raise here is: every human being has a tendency to »give» a meaning to a drawing, even if this meaning may switch (compare Fig. 1: 4. »My wife and my mother-in-law«).

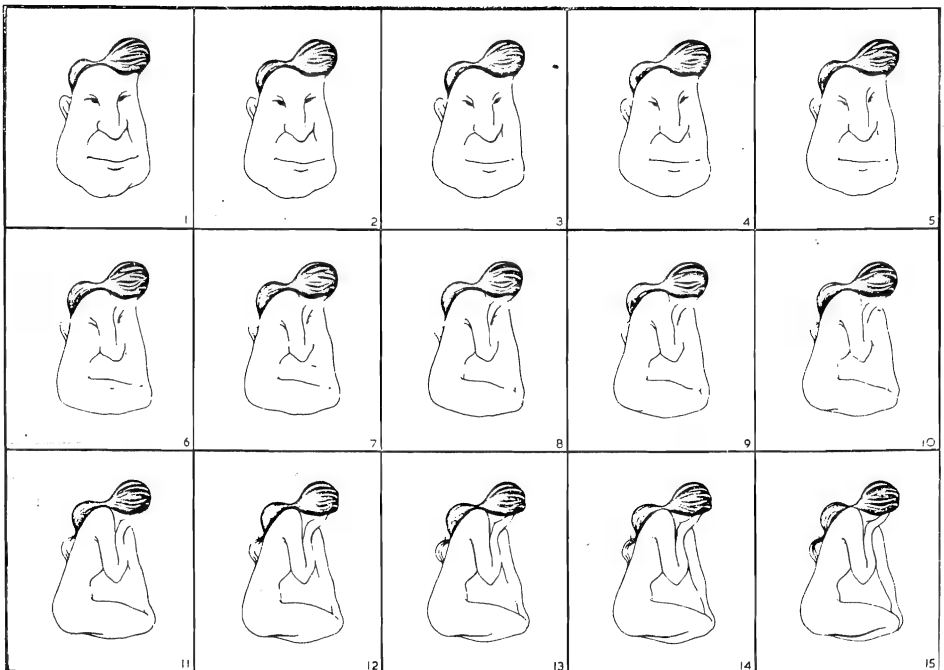
The System of Meanings. — Until now I have shown some drawings which can receive the meaning of being representations of real things, for instance faces. In order to continue our study it would be helpful if we could

carry out a survey of the realm of meanings, and find some way of classifying different kinds of meanings.

Signals and Signs. It could be said that, to a certain extent, man shares his ability to see meaning in all that surrounds him with the animals. The difference is that the animals can never analyze their perceptions. But there is also another significant difference.

Understanding the meaning of a perception implies, for an animal, that this perception is a *signal* for a certain action. A cat, for example, sees something which means »food«, possibly a special kind of food, for instance »rat«. For the cat this implies a signal for action in order to seize and eat the food. In this case, the cat, in its entire psychological and physiological apparatus (digestive glands, etc.) enters into a certain state, directed towards this action. The animal's reaction may be complicated by influences of various kinds. Pavlov's well-known experiments with dogs were devised with a view to substituting a new »artificial« signal for the original »natural« signal.

Fig. 14:3. From an old man's face to a young girl. (After Fisher.)



He was able to make the ringing of a clock a signal for a dog to take food. When the dog heard this "artificial" signal, it prepared itself, perhaps psychologically, but certainly physiologically, its digestive secretions began to flow, etc.

Even for a human being, a thing may be a signal for a certain kind of behaviour. The gong sounds and we sit down at table and eat. We see a certain traffic light and start our car moving, etc.

In this connection, it is also customary to speak of *signs*. A traffic policeman makes a *sign* to the motorist, who "obeys" this sign.

Symbols. For animals, signals would appear to be the most essential meanings, and perhaps the only ones. But for a human being the meaning of an object may, in addition, appear *instead of* another meaning, as a *symbol* of the latter. The simplest way of understanding what this means is perhaps to imagine that one is making a symbolical representation of a mechanical device, for example, a plan of couplings of the electrical circuit in an intricate piece of machinery. Every detail in this plan *takes the place* of the real detail — rheostat, commutator, fuse, etc. — they are all symbols for the real things. The first field in which human beings made use of symbols was, however, language. Every word is, from the outset, a symbol for a concept, an object, an attribute or an action. The symbolic meaning of words is a problem to which philosophers have devoted much thought. This study is commonly named "semantics". Since, however, words as symbols are only one kind of meanings, we might be allowed to say that there exists a wider realm of "semiotics", dealing not only with words, written or spoken, but with all the kinds of meanings that can be attached to any kind of perception.

Representation, Copy, Replica, Picture. — Many of the illustrations in this book are either photographic or drawn *representations* of objects. A representation is a symbol in so far as it is a substitute for the real object, which cannot be inserted into a book. At times, a representation may be found inadequate, and then a *copy or model* is required; for example, when one wishes to give information about some detail on a building site. The difference

between a representation and a copy is, that a representation shows only the most characteristic attributes of the original, while a copy shows all the details of the object, and — above all — presents them in the same modality of perception as that of the original. A sculpture can, for example, be represented by a photograph, but it can be copied only as a sculpture. If the copy is made the same size and of the same material as the original — for example, if a marble sculpture is copied in marble — we often speak of a *replica*.

Finally, if something which appears to be a representation — for example, a naturalistic picture — is not a representation of some object which can be perceived, but only exists in the imagination of the artist who created it, we do not speak of a representation but of a *picture*.

It is, however, evident that a representation, a copy, a replica and a picture all have one characteristic feature in common. They are all used *instead of* something else, namely *instead of* a perception or a fantasy and this is also characteristic for a symbol. A symbol, however, is a wider concept, since it comprises such meanings as are used in place of the non-perceivable (for example, words for abstract concepts).

Expressions. — Both signals and symbols must be distinguished from a third kind of meaning, namely *expression*. If someone's face has an angry *expression* this does not imply that this person is merely exhibiting a symbol for an emotional complex that he has. The angry facial expression forms a part of the physical and mental totality which the angry person represents. In a similar manner the *architectural expression* forms a part, as the semiotically active component, in the mental totality which the experience of a consummate piece of architecture involves. Architectural expression, however, is not the same as the expression of an emotion. *Emotional expression* is treated in a special section of this study: the aesthetics of emotion. Architectural expression is an entity which cannot be defined nominally, but only ostensively; the following analysis will clarify both its nature and the role it plays in the experience of architecture.

Symptoms. — Certain authors wish to make still further distinctions respecting the attributes of a meaning. Thus they do not call a person's angry appearance an expression but a symptom of anger, and they consider that expression and symptom should not be regarded as synonyms. Under certain conditions, this distinction is perhaps justified, but as far as architectural theory is concerned, it should be quite sufficient to treat expression, including symptoms, as *the third attribute*, in accordance with the description given above. The other two attributes of meaning are the symbol — »the-instead-of« (substitutive) meaning — and signal — the behaviour-release meaning.

15 Meaning and Perception

Meaning and Information. — Modern perception psychologists stress that meanings have a practical purpose: they inform us about something in our environment. Thus a round object with red and yellow-green colours may have the meaning of an apple, which means that we are informed that this object can be eaten. But to Architectural Theory this is not really very interesting, the most important fact is that we, quite independently of material or practical needs, evaluate the meaning itself, positively or negatively. The meaning has begun to live a life of its own within us, together with all the other factors or elements in the world of perception. This is the reason why we are now going to begin our study of architectural expression, perhaps the most important kind of meaning, important because we can never escape it when we are living in a man-made environment like a town.

How a Meaning is Connected with a Perception. — If signals, symbols or expressions are to be comprehensible, the one who perceives must give them the same meaning as their authors. A meaning can be connected with a perception in one of the following three ways:

1. An *agreement* is made that one meaning or another shall be given to a perception — *conventional meanings*, "conventional" here implying conscious or unconscious agreement.
2. As a result of previous experiences, a meaning is connected to a perception according to the laws of association — *associative meanings*.

3. A meaning may be attached to a perception according to some natural relation — *spontaneous meanings*.

Conventional meanings. — An example of a conventional meaning is given by a national flag. In Ethiopia, it has been consciously agreed that three stripes of colour, green, yellow and red, shall be a symbol for the Ethiopian nation. They can represent the whole nation, but they are only understood to do so by someone who has been told what the symbol means. Should the symbol be insulted, however, it would suffice to start a war.

Associative Meanings. — Two persons sharing the same culture, and the patterns of behaviour of the culture, can have for example been educated into acquiring private associations between, let us say, »trousers» and »men»! To both persons, trousers are symbols of the male sex and manliness, where as in another culture, for example, the Eskimo, no such association exists. Such kinds of meaning can only be understood by persons of the same culture, although they do not need to have agreed about the meaning they have acquired from private associations. It is not easy, however, to draw a clear boundary between conventional and associative meanings.

Spontaneous Meanings. — What is of the greatest interest to Architectural Theory, however, is the fact that some kinds of meanings are spontaneously attached to certain perceptions. No one will, for instance, confuse the appearance of a human face with that of an animal, and still less with that of an inert object like a building. We shall in the following chapters concentrate on the way in which certain meanings can be spontaneously attached to the perception of a piece of architecture.

16 Architectural Expression

In architecture, one can speak of visual, auditory, haptic and tactile Gestalts. In studying the semiotics of these, the first question will be: Do there exist any other spontaneous meanings except facial expression, gesture, and sign language? These three kinds of meanings imply a perceived motion or change. It is not the static gesture which carries the meaning but the facial or pantomime movement. Such motion is however rarely used in

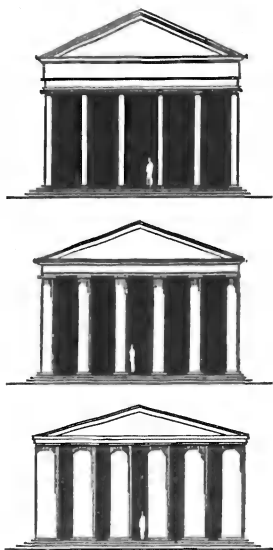


Fig. 16:1. Supporting colonnades. (After Woodworth and Marquis.)

architecture where Gestalts are *static*. This does not, however, preclude their transformation into *images* (conceptions) of motion.

If some spontaneous architectural meanings can be found, it will also be of interest to study the pattern of evaluation used for them. To demonstrate this, an analysis is given of a typical case, taken from that common subject for discussions about architectural values, the Greek temple.

Fig. 16:1 shows three alternatives for the colonnade gable of a Greek temple used by the experimental psychologists Woodworth and Marquis.

When a number of subjects are asked »which colonnade gives the best expression to supporting?» they will all give the same answer. The columns at the top seem too weak, and the ones at the bottom »make themselves ridiculous as they are so many and so strong, yet carry so little with each other's help». This common answer indicates what is spontaneously judged as the most obvious expression of the idea of support. There is an inclination to call this expression the »best» and the »most beautiful» one as well, providing an answer with a characteristic of aesthetics too.

Expressions of this sort are found nowhere else but in architecture. This could perhaps be better phrased by saying that whenever such expressions are met, the experience tends to be that of a piece of architecture. In the following chapter, the special characteristics of architectural expression will be analyzed.

True and False Expression. — Fig. 16: 2 shows a steam engine, built in 1840 in the early days of modern industrialization, on which Greek columns have been used because of their officially acknowledged »beauty». However, they do not seem to belong on an engine, they do not *express* anything about machines; they have in fact passed over from being »true expression» to meaningless decoration, and have lost their semiotic value.

Another somewhat different development is given by modern ships. A yacht with its sails gives a clear visual idea of how it is propelled, by the wind, and this is also »beautiful». See Fig. 16:3. The first steam-driven boats



Fig. 16:2. Steam engine with Greek columns.

Fig. 16:3. Sail-ho!



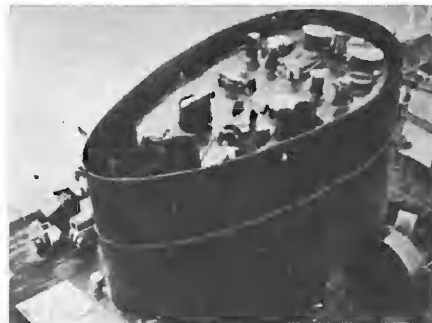


Fig. 16:5. This funnel has no "true" expression.

Fig. 16:4. Funnel and smoke, expression of the propelling forces.

were hybrids between sail and steam ships. The funnel was at first looked upon as something evil which could not be avoided, but as the sails disappeared, the funnel and the smoke issuing from it became an *expression* of the way the ship was driven, of the forces which had replaced the wind as a propellant. Fig. 16: 4.

Nowadays as steam has in its turn been replaced by diesel engines, the funnel has remained although its technical purpose has disappeared. This is because marine architects are mostly conservative people, and because for the layman the funnel still expresses the idea of the propelling force. The well-informed man, however, will experience the funnel as a »false» rather than a »true» expression, with no reality behind it. Fig. 16:5. This symbol will then be given a negative value. The question whether an expression is *genuine* or not, implying a logical evaluation together with the aesthetic one, is something which is checked by the intellectual understanding. In this way, not only feeling but intellect too enters into architectural evaluation.

To the intellectually inclined, it appears essential that "beauty" must include an expression for the new impelling force corresponding to its nature. The designers of

Fig. 16:6. Stephenson's "Rocket". Photo Science Museum, "British Crown copyright".

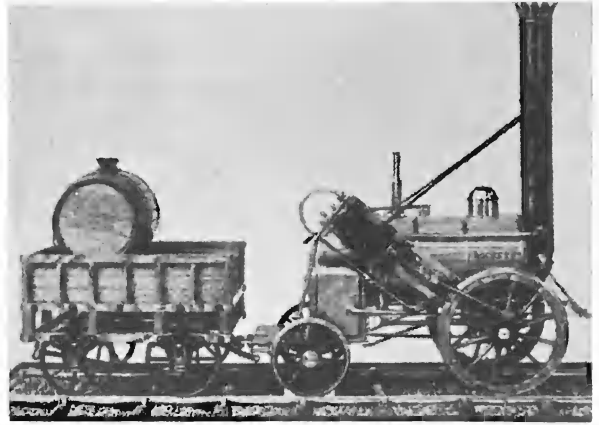


Fig. 16:7. Steam locomotive, expression of driving forces.



railway trains seem to have had more success here. George Stephenson's »rocket«. Fig. 16: 6, was regarded as the most beautiful locomotive at the Rainhill competition in 1829. The modern steam locomotive, shown in Fig. 16: 7, has been developed from this. The similarity between the expression of the locomotive in this picture and that of the steamer in Fig. 16: 4 should be noted carefully.

The demand for genuine or true expression has been sometimes stressed and sometimes neglected throughout history. It is the author's belief, however, that the greatest connoisseurs of architecture have always agreed on this norm of evaluation. Differences of opinion have apparently arisen from different ideas on how such a norm should be applied, and the manner in which the connection between the expression and the technical reality should be created.

Some spontaneous expressions relevant to architecture will be sought out in this part of the book, and this process will show that visual form is the most important perception modality, although other kinds of perception can play prominent roles.

17 Expression of Function, Production and Material

The most important fact concerning the experiment carried out by Woodworth and Marquis, described in the previous chapter, is not that a certain form is judged as having the »best« expression of support, but that all subjects understand the question: »Which colonnade gives the best expression to supporting?«, and are able to answer it. This means that everyone is sensible to this kind of meaning.

The Visual Expression of Function. — As has already been pointed out, a common »understanding« of a piece of art will depend on whether the meanings connected to the perception are based only on private associations, or whether they are given spontaneously to the perception in accordance with some basic structure of the human mind. In the following, reasons will be given for why the good architectural expression of function is based on such spontaneous and elementary phenomena. The analysis



Fig. 17:1. The form of the handle expresses its function.

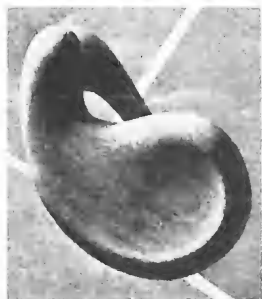


Fig. 17:2. A handle to push ...

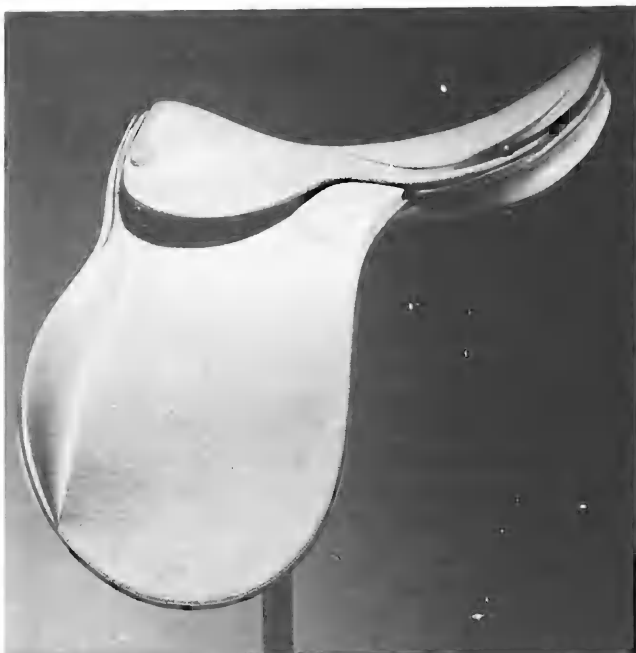


Fig. 17:3. ... and one to pull. Designer, Møller-Nielsen.

will begin with a list of the most common and typical practical functions.

To be Grasped by the Hand. The handle of the iron shown in Fig. 17: 1 is meant to be grasped by the hand. This practical aspect has apparently been the starting point for the man who made it, but he seems also to have taken the expression of that function into thorough consideration. This object's visual and haptic form makes us well aware, without being otherwise informed, that it is in fact what we call a "tool".

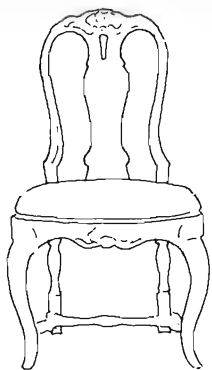
The problem of making «push-pull» handles so as to give a clear expression to their function is a problem of practical signals as well as of aesthetic expression, and one in which modern architects are very interested. Some architects have co-operated with sculptors in this work (see Fig. 17: 2 and 3). The illustrations give an idea how the visual perception of the form is changed into a haptic image — the basis for the expressions «push» and «pull». The pleasant haptic expression here is based on smoothly rounded forms without sharp edges or straight lines. Tactile sensations also play their part since it is more preferable to handle a smooth surface than a rough one. The transformation tendency is also at work in the transformation of visual glossiness into an image (conception) of tactile smoothness.



*Fig. 17:4. English saddle.
Designer, Palmgren.*

Expression, in this case, is generally speaking based on the transformation tendency from visual perceptions to haptic and tactile images (conceptions).

To Support a Human Body. If a visual form is to express its purpose of supporting a human body, sitting or lying, the form perception must have a tendency to change into an image of a comfortable haptic form and kinesthetic experience given high value.



*Fig. 17:5. "Sit down,
please!"*

To someone who rides, the shape of an English saddle, one of the most beautiful objects ever created, will give this expression of supporting. There, a high formal aesthetic value is combined with an extremely clear expression, Fig. 17: 4.

It would be difficult to give a better verbal formulation of the semiotic value discussed here than Malmsten in his description of the Swedish chair shown in Fig. 17: 5.

»By their whole design, such objects suggest relaxation; they are expressionistic sculptures of the invitation, 'Sit down, please!'. Neither the material, wood, nor the constructional necessities, nor the demands of com-



Fig. 17:6. Containing and protecting a content.

fort have dictated the form, as chairs can be made quite as comfortable and much more simply yet lack this heartily inviting character.»

The expression of containing or supporting something other than a human body, an object, fluid or gas, cannot be described or explained by a transformation tendency as in the last two cases. What the designer has to do is to create a form — a container for example — which will be an expression of the forces which must function within its walls and make it capable of resisting pressure from its contents. The photograph of the tureen in Fig. 17: 6 shows that the form stresses the fact that it contains and supports its contents. The buoyant contour seems to react against the heaviness of its contents and strives energetically and successfully to withstand pressure from within. The handles do not hang limply without expression; they are worn and inviting to grasp. The cover forms a vaulted arch protecting the contents. The total form makes a closed and expressive Gestalt, and its expression can be described as containing and protecting in combination with easy handling.



*Fig. 17:7. Water tower.
Architect, Lindström.*



Fig. 17:8. Old pewter coffee-pot.

Other forms of containers which have a definite expression of containing or bearing something are found in the next illustrations. Fig. 17: 7 shows a Swedish water tower, Fig. 17: 8 an old European pewter coffee-pot, Fig. 17: 9 a modern Swedish silver coffee-pot.

Up to now, containers for shapeless material such as fluids and gases have been described. Objects can have definite forms, however, and for carrying such objects, bowls are not necessary. The function of simply giving support can be expressed by a table, with a top and four legs.

To Deal With Static or Dynamic Forces. Such an expression can be described as one of bearing, support, or tension. The strength of a supporting architectural detail can be symbolized in such a way that the detail may represent a strong man, an elephant and so on. For more developed tastes, this function can be expressed more adequately without using representations or symbols. In Chapter 16 the classical example of this expression, the Greek temple, was introduced. Today, techniques are more developed, (e.g. reinforced concrete) while on the other hand, much more complicated functions have to be expressed.

This form gives a fair expression to the function of simple bearing but it is sometimes necessary to create a structure which not only bears but bends like a bow. Fig. 17: 10 shows the Salginatobel bridge in Switzerland, a classical example of such fusion of expressions. The supporting and tension stay, the vault, the flying buttress and the beam also belong to this group of expressions.

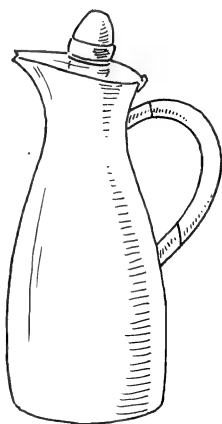


Fig. 17:9. Modern silver coffee-pot.
Designer, Gillgren.

To Protect and Hem in. Visual hemming-in — sometimes appreciated as a protection, sometimes avoided as a hindrance — is one of the most important architectural expressions. The expression of hemming-in given by inner floor, walls, and ceiling is so important that it must be referred to in some detail later. For the moment, it is enough to say something about the expression of certain exterior walls and roofs.

It has already been mentioned how the high arched cover of a steak dish can give a good impression of protection.



Fig. 17:10. The Salginatobel bridge. Engineer, Maillart.

The same holds good for a building, where a steep roof can give a strong expression of protecting. A flat roof gives a weaker impression, but this can be compensated with heavy eaves well visible from underneath. Buildings without eaves seem more unprotected.

Other perceptions add to the attributes of visual form. Dull and dark colours, and a pronounced texture, especially a pronounced deep texture, contribute to the expression mentioned. Evidence in support of this thesis can be found plentifully in our everyday surroundings. Fig. 17: 11 serves to remind us of the fact that a high and dominating roof with a strong depth-texture gives a definite expression of protection.



Fig. 17:11. Dominating roof, expression of protection. Architect, the author.

To Open Up and Connect. The expression of protection can become so strong that it develops into an expression of closeness or stuffiness. In such a case, it may become necessary to insert doors and windows in the walls. These elements will visually connect the closed room with adjacent spaces. The perception of a door — even when closed — is transformed into an image of unimpeded motion, whilst a window which does not reach the floor is connected with the idea of protected outlook. If the window does reach the floor, it is likely to combine with an image of unimpeded motion as well. Such an image can become very unpleasant if the window is many storeys above the street. In well-designed buildings it can sometimes be seen that the architect was aware of this, and has therefore placed the windows higher on the wall on the storeys furthest from the ground.

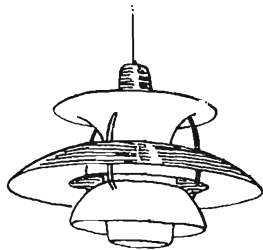


Fig. 17:12. The PH-lamp. Designer, Henningsen.

To Distribute. One visual form which expresses very well the function of distributing light, sound, air and water, is the trumpet form, which, with sufficient variation can be used for light fittings, megaphones and air mouthpieces.



Fig. 17:13. The motor-boat makes its way through the water.

The PH-lamp in Fig. 17: 12 is a classic example of a very convincing expression of distribution. This light fitting is about forty years old, but is still looked upon as modern design.

A funnel-shaped object can also have the expression of catching and sucking in air or sound, as the steam boat ventilator and the old-type telephone mouth-piece show.

To Move and to Be Stable. A function which classical architecture was never confronted with, because it did not exist when such architecture was being created, is the function associated with the ability of ships, cars and aeroplanes in rapid motion to cleave their path through air or water. Streamlining is the expression of this function in visual form. The visually streamlined form is not always the same as the correct hydro-dynamic form. The motor-boat in Fig. 17: 13 gives a definite expression of speed and efficiency as it makes its way through the water, and the sharp steam probably makes the most important contribution to this expression. The hydro-dynamically correct form, however, is quite rounded and

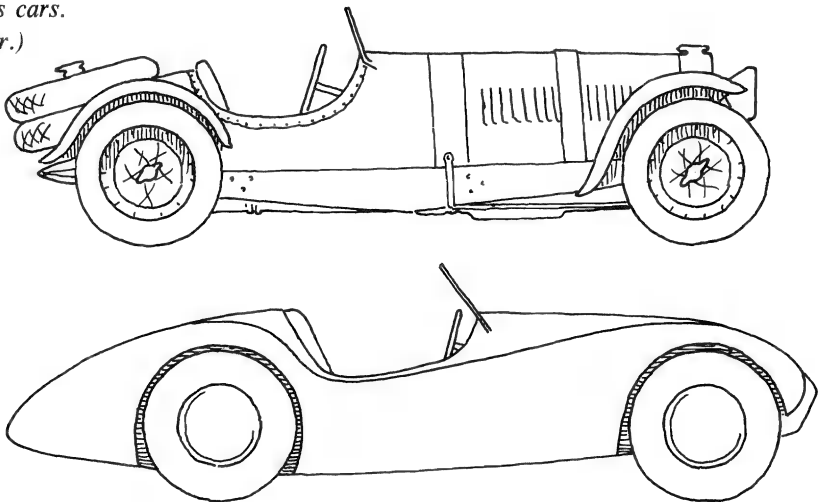
blunt both above and below the waterline, and is only sharp on the waterline itself; and yet until recently, even large cargo boats all had this same »visually correct« sharp stem.

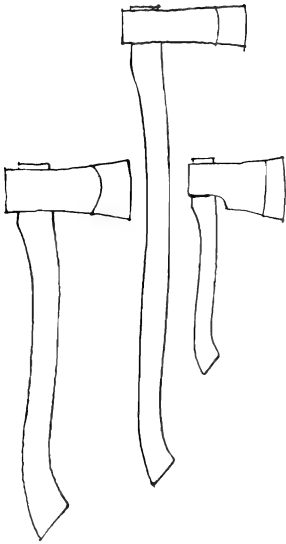
Certain perceptions other than visual form can also contribute to the expression of speed, for example visually glossy and tactually smooth surfaces.

This dynamic expression is entirely based upon a transformation tendency from visual perception to image of motion, and is, therefore, closely connected with formal aesthetics. Expressions of function are such that an understanding of the often rather complicated functions to be expressed is necessary before the expression itself can be appreciated. Today modern cars are widely distributed among people who have not yet acquired such an understanding, and since the form of the car has to suit the taste of the owners, the form of modern cars has developed in the way shown in Fig. 17: 14. To quote from Garnier:

»The great cars of the past gave the impression of power, and implied speed by the length of their hoods, though their lines were singularly static. The modern ones give a similar impression with their flowing lines, all of which imply movement even when the car is stationary.»

*Fig. 17:14. Classic and modern sports cars.
(After Garnier.)*





*Fig. 17:15. The forms express the different functions.
(After Brochmann.)*

To this it should be added that in old cars every detail gave a good expression of its function, while modern cars lack such semiotic values. The car of today is "reduced" to a play of lines, a form which, by transformation to an image of movement, gives an impression of speed; this expression is very similar to what will later be described as a sensorial emotion, and ought perhaps to be included in the realm of emotional aesthetics. Whether this "reduction" is to be regarded as a positive or negative development depends upon the evaluation norm. It might perhaps be expected that the older evaluations will become more valid again when interest in cars increases. Modern interest in "vintage" cars would seem to indicate this.

The Expression of Tools. Tools which are meant for "dressing" or manufacturing have a special kind of semiotic interest. They very often give an expression of their function that is spontaneously created and spontaneously perceived. With regard to the axes shown in Fig. 17: 15, Brochmann stresses that their aesthetic value depends upon the expression of their function, which can immediately be appreciated by anyone who has seen such axes in use. The three axes shown in the illustration have three different and specialized functions which are mirrored in the differences in their forms. To the initiated, such variations are absolutely natural and »right«. This understanding of the expression is so spontaneous that nothing more can be added to it by theoretical knowledge.

This implies something that is very essential: Architectural expression cannot be fully understood merely by the reading of books. Practical experience is absolutely necessary.

The Expression of Complicated Functions. Up to now, the expression of some particular, fundamental functions has been dealt with. In reality, an object, and even more a building, must give expression to manifold functions, some times of a special nature not covered in this chapter. No rules can be given as to how these complicated functions should be expressed. The creative imagination of the designer or architect must be left to solve the particular problems as they are encountered.

To avoid any possibility of error, it must be stressed that the functions that are discussed and described here are *practical, physical* functions. To say that a building has the function of giving expression to a certain way of living, or to a certain attitude to life, is to indicate a kind of expression quite different to those dealt with here. The study of such types of expression properly belongs to the realm of emotional aesthetics.

The Visual Expression of Production. — As has been explained previously, we cannot often visualize the purpose of an object without at the same time visualizing how it is produced. In theoretical analysis, however, it is necessary to make a distinction between these two concepts. Thus, we talk of *the expression of function* as something separate from *the expression of production*.

A list of the expressions of production can only be a list of examples, since new technical procedures create possibilities for completely new expressions, and technical procedures are changing or developing continually. These expressions indicate a great deal about the creation of an object to those who have the talent necessary for appreciating the expression of production and who also understand the technical procedures. But the layman frequently shows such an appreciation too.

The following main groups of production expressions can be mentioned:

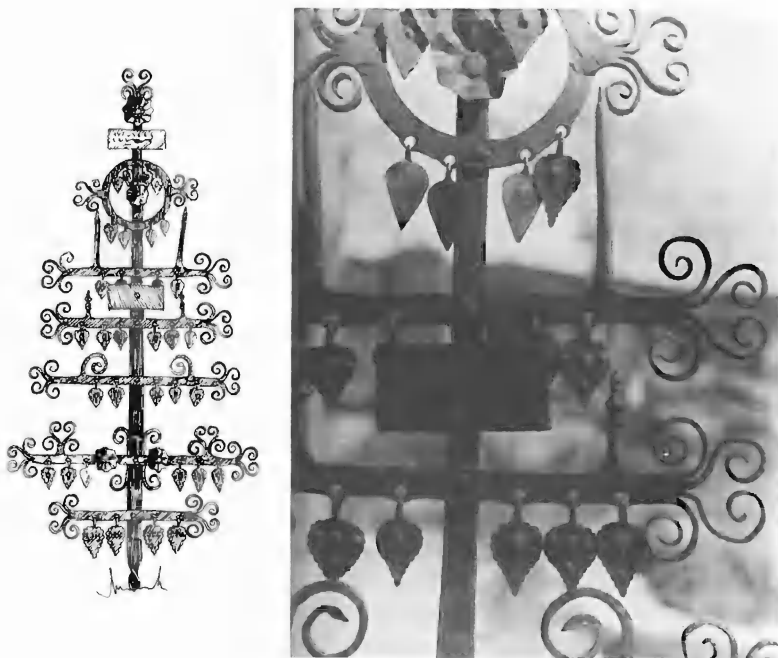
Cutting Off Material. The first possibility that man had for the creation of an object was probably to cut away some material. This manner of production is very evident from the results it produces. In Europe at least, this manner of making things has been very much appreciated. Fig. 17: 16 illustrates an example from the Olofskolan, a well-known school for handicrafts in Stockholm run by Prof. Malmsten, who has also been quoted as a pioneer in the theory of design. The object shown is an ash-tray cut from a solid block of wood.

The visual expressions for sawing, planing, dressing, turning, boring, milling, cutting and so on also belong to this category.



Fig. 17:16. Ash-tray of wood.

Fig. 17:17. Iron memorial cross. (After Jonsson and Hellner.)





*Fig. 17:18. Clay pottery.
Anonymous designer.*

Modelling a Given Quantity of Material. The next major group of production methods having a definite expression can be described as the modelling of a given quantity or amount of material into a new shape. Wrought ironwerk, moulding, casting, chasing, throwing, rolling and so on belong to this group. The illustrations show some European products which are typical expressions of this type of production. Fig. 17: 17 shows a memorial cross from Sweden made in 1783. Many old-fashioned and different ways of handling the material iron have been used in it, and this is well expressed in its form.

A pot can be made in two different ways. It can be built up by laying one ring of clay on top of another and smoothing the whole object with the thumbs. This is the most common method of potting in Ethiopia. In Europe another method is in use which has a very long tradition behind it — throwing (on a wheel). Fig. 17: 18 shows the expression of this method of production.



Fig. 17:19. Plaited baskets.

Plaiting. Plaiting and weaving are indeed venerable techniques and have been used all over the world. Fig. 17: 19 gives an example from Sweden demonstrating the way in which the appreciation of the expression of this technique is closely combined with a formal aesthetic evaluation of the pattern that this technique creates.

Heaping Up or Piling Up. The simplest way to put things together to form walls or columns is to place them on top of one another with or without mortar or glue. Masonry with brick or natural stone, columns and barrel vaults and so on may be included among this type of expression.

Fitting Together. The putting together of objects by assembling different closely-fitting details is a technique which, from the point of view of expression, is often highly appreciated. This matter can best be described by



Fig. 17:20. Arm and leg are fitted together.

means of illustrations. Fig. 17: 20 shows how the arm and the leg of a chair are fitted together. There is a long tradition behind this technique, good examples being provided by the old timbered houses of Scandinavia. Fig. 17: 21 shows the fitting together of wood and natural stone in a Japanese example. This illustration also gives an example of joining-elements.

Joining-Elements. It is sometimes necessary to assemble parts of a building by joining-elements made specially for this purpose. From the almost unlimited number of examples possible, two have been chosen at random. Fig. 17: 22 shows the Forth Bridge in Scotland, a pioneer work of its kind, in which the iron details are riveted together. Fig. 17: 23 shows one type of locking system.

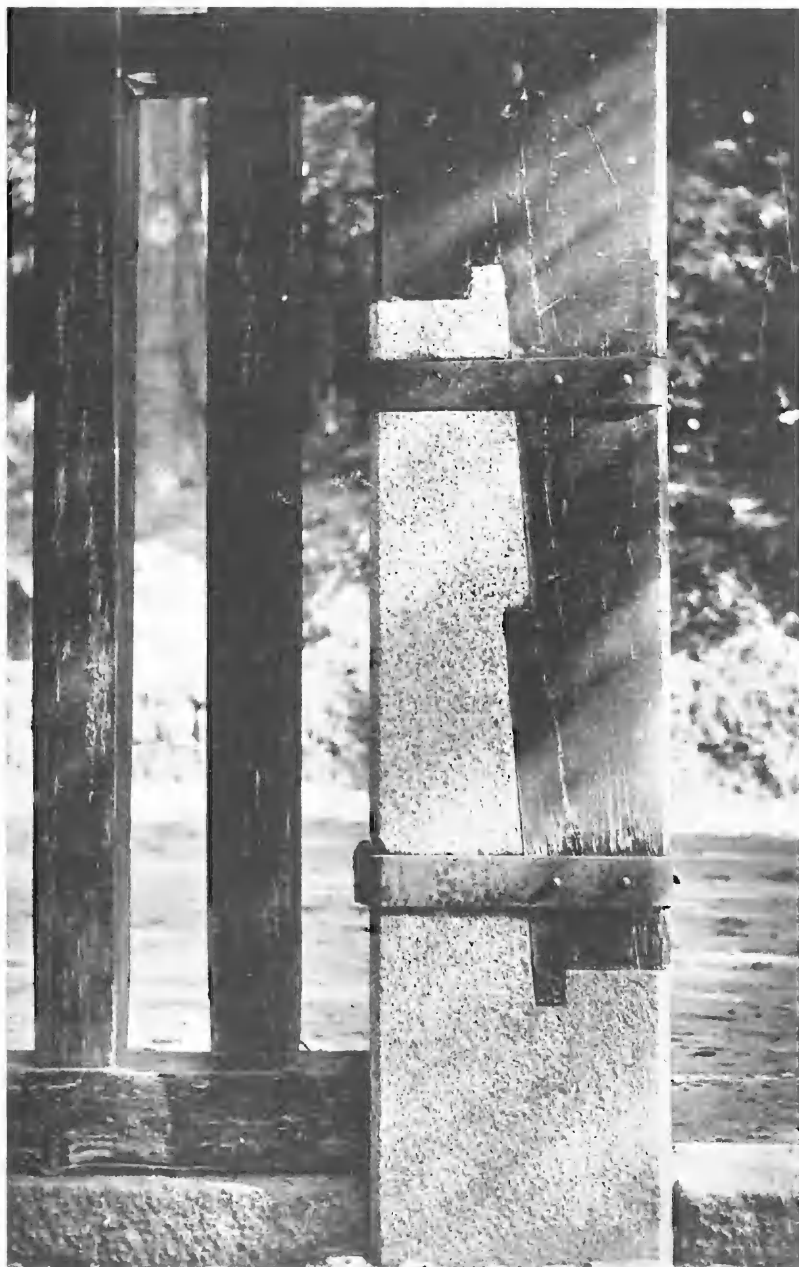


Fig. 17:21. Wood and natural stone fitted together.

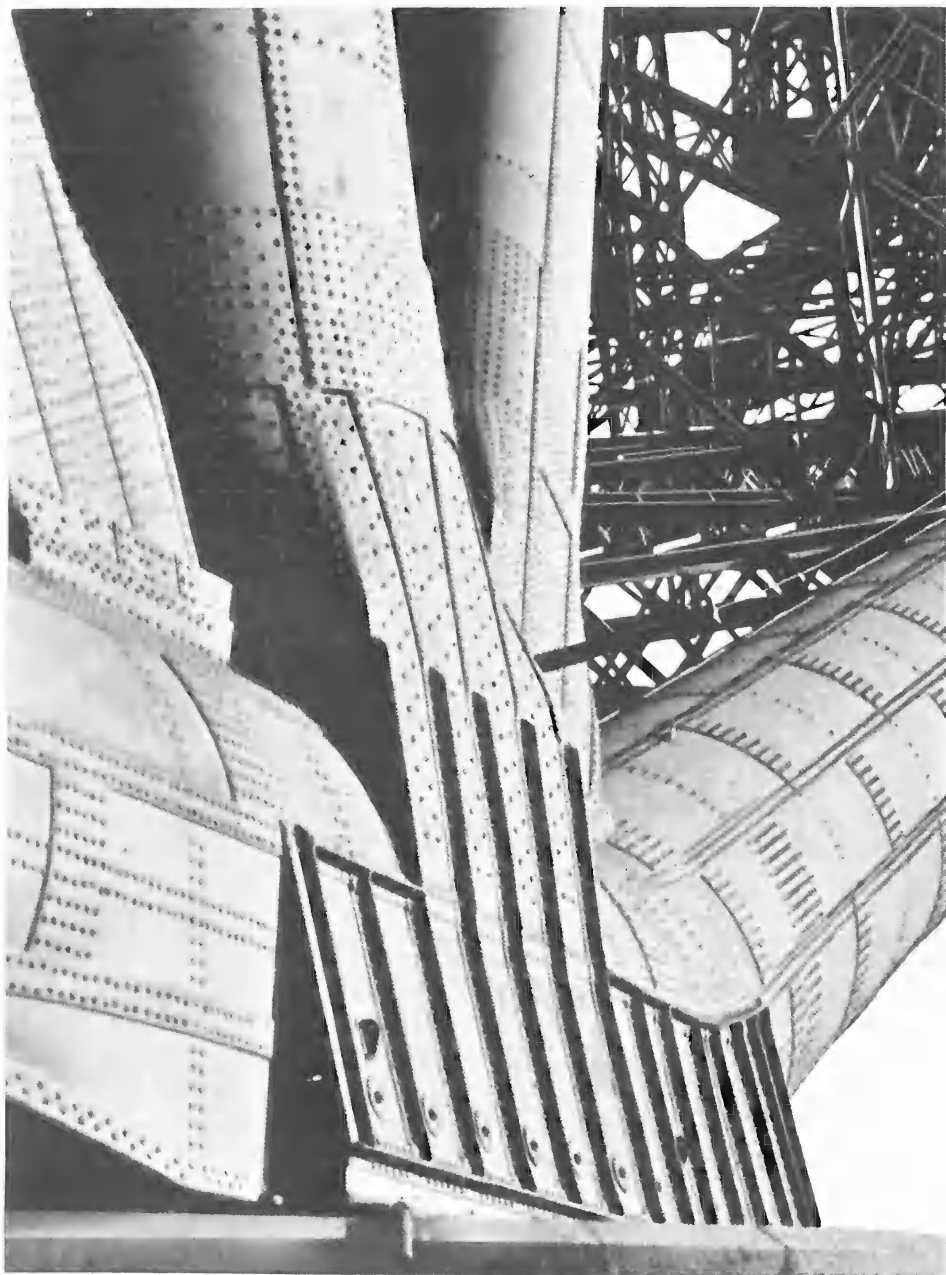


Fig. 17:22. Forth bridge. Engineers, Fowler and Baker.



Fig. 17:23. A locking system. Engineer, Wachsmann.



The professional engineer or architect will obviously appreciate this kind of expression more than the layman, especially as a proper technical understanding of the structure lends highlight to the expression.

Frameworks. The construction of a framework in which the openings in the frames can be filled with sheets of wood, glass, iron plates and so on is another very old method of construction which gives an expression that is very highly appreciated. Fig. 17: 24 shows an old example from Norway. Today this method of construction is used on a much greater scale with frames of concrete and fillings of another materials. Fig. 17: 25 is taken from Siegel whose book should be studied as an excursus to this one. It gives a very penetrating analysis of modern concrete technique and its possibilities for true architectural expression.

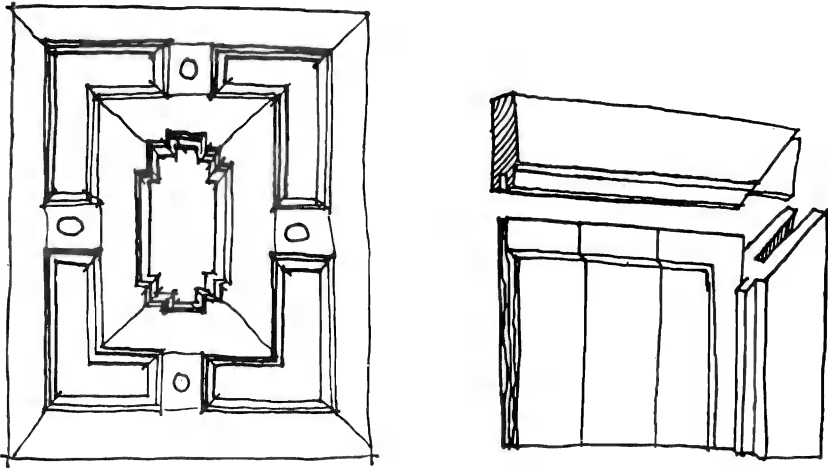


Fig. 17:24. Old Norwegian door. (After Brochmann.)



Fig. 17:25. Framework and fillings.

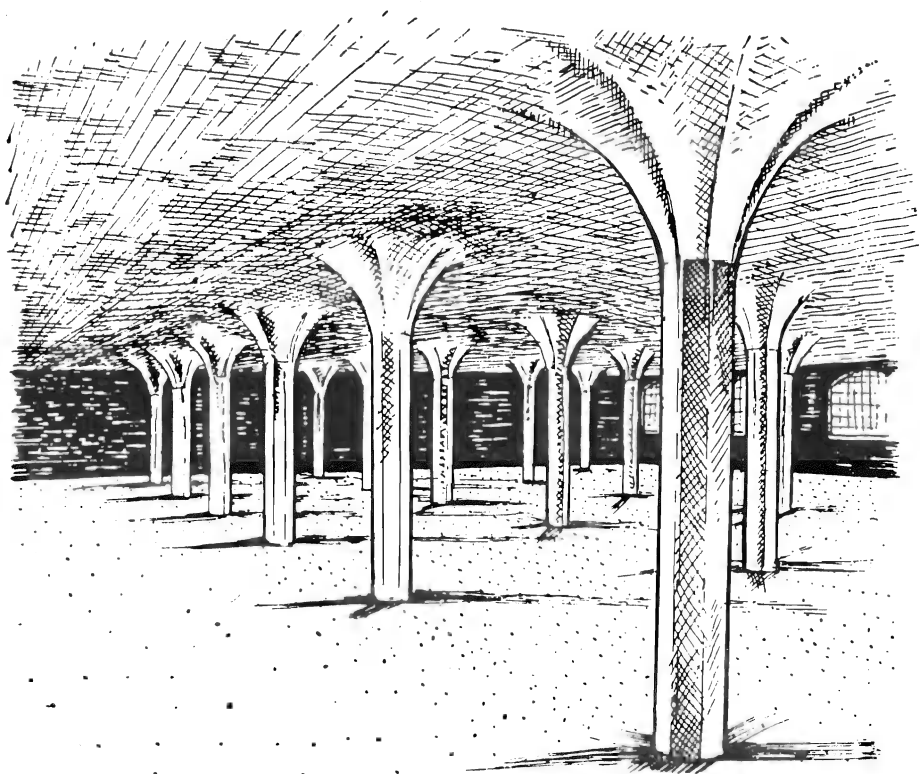


Fig. 17:26. Mushroom structure. Engineer, Maillart.

Fusion. The use of the intimate fusion of different elements in similar or dissimilar materials is a relatively new technique based on certain modern inventions such as reinforced concrete, plastic-laminated plywood and welded steel structures. The illustrations show three pioneer works from Europe; Fig. 17: 26 is Michael's illustration of the first mushroom structure in 1910; Fig. 17: 27 is an easy chair from Finland, about 1930. This latter was perhaps the first attempt to use this new idea in industrial production, and it shows very well how these new methods can be given a beautiful expression. Fig. 17: 28 shows a Swedish welded roof beam from 1950 and this is at least the first Swedish attempt to create an industrial product based on these methods satisfactory from a technical, economic and aesthetic point of view.

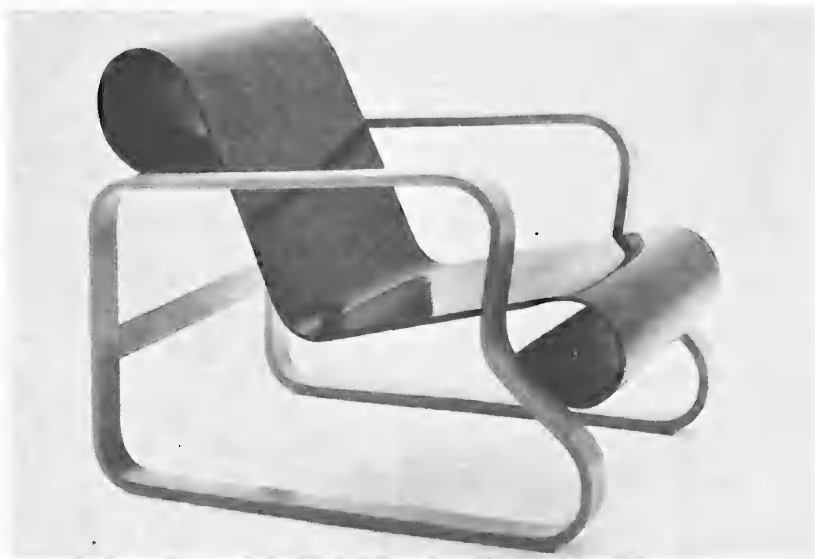


Fig. 17:27. Easy chair. Designer, Aalto.

Fig. 17:28. Welded roof beam.



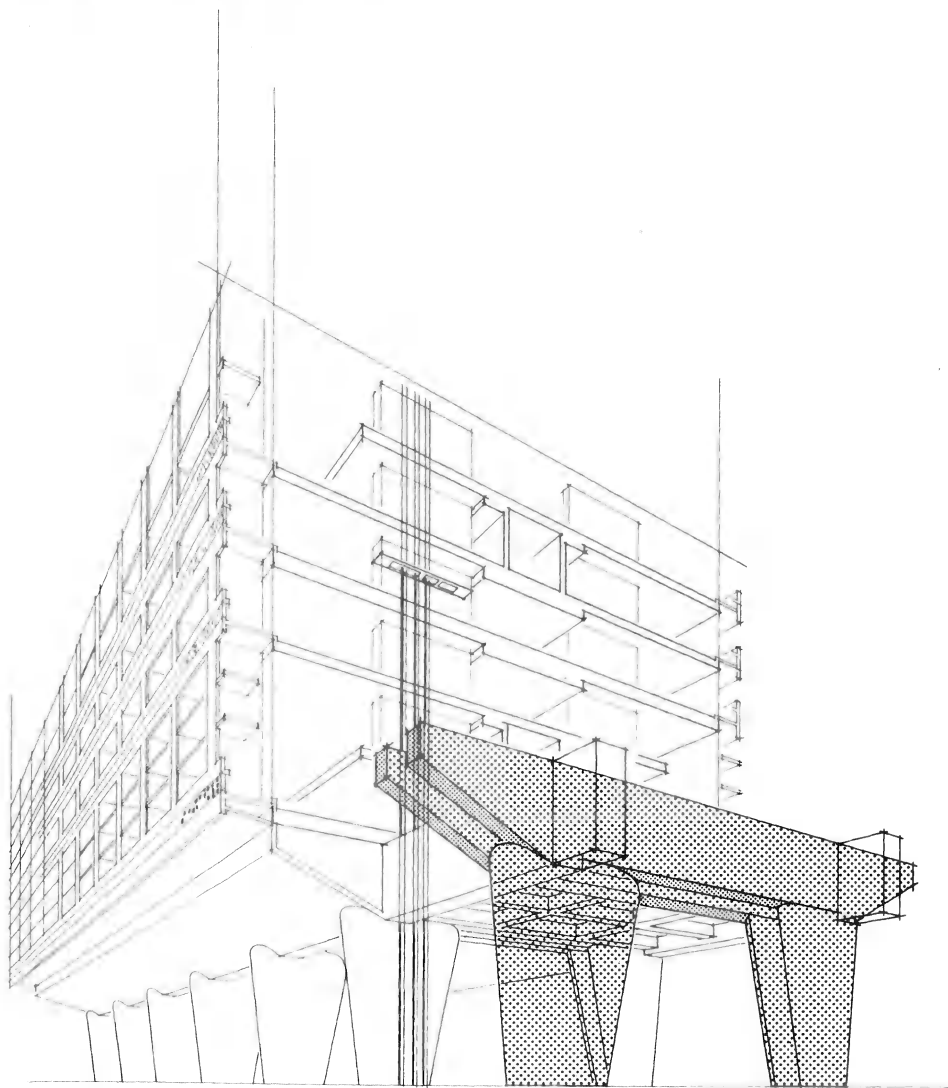


Fig. 17:29. *le Corbusier's V-legs. (After Siegel.)*

The fusion described here is perhaps the most interesting of the new techniques of the modern era, and is of great interest from both a technical and an architectural point of view. It should be studied carefully by any architectural student. Here too reference must be made to Siegel's book as the most advanced work on this subject up to now. Siegel also analyses the *combination of fusion and framework*, a complicated technique which may in future

be regarded as the greatest contribution of our time to architectural development. Fig. 17: 29 gives an example of this. It is a drawing of the frame construction and V-legs, at ground level, of le Corbusier's well-known apartment building in Marseilles.

The Visual Expression of Material. — We are now going to study the last of the three great categories of semiotic values — the *expression of the material* connected with a perception.

In fact, the expression of a material can seldom be separated from the expression of production — architecturally speaking, to produce always means *to produce in some material* — but in theoretical analysis it is necessary to make a distinction between the two concepts. Any description of the expression of material must, however, involve a description of how different methods of production and finishing have influenced the appearance of the material. Certain production methods are more »natural« to a given material than others. In the following, the most important materials will be listed and the expressions of such materials connected to their perceptions will be described. In this way it is hoped that a satisfactory ostensive definition of the concept will emerge.

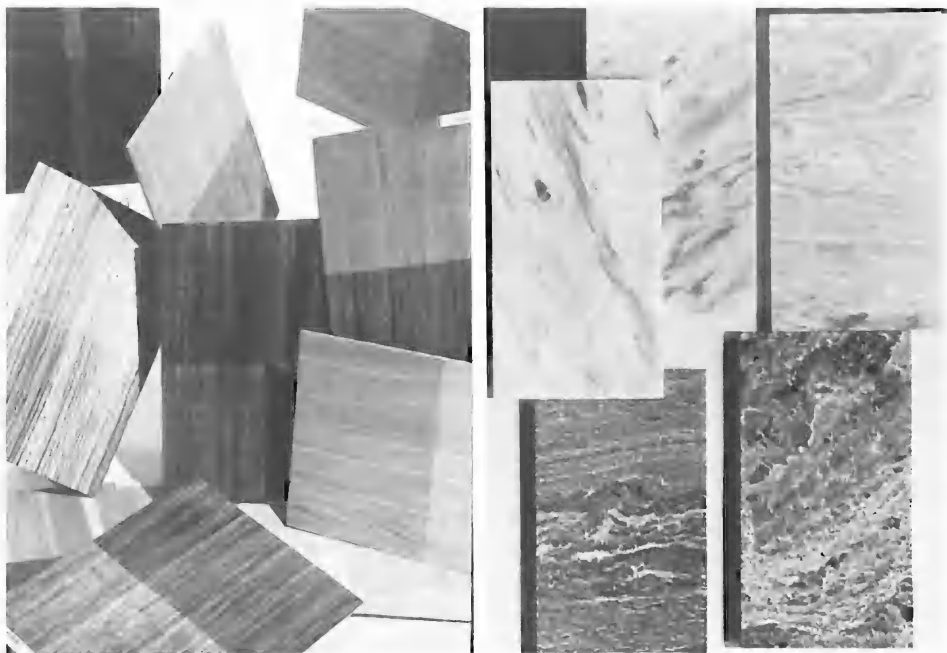
First, however, something must be said about the semiotics of tactile and visual texture sensations, in order to illustrate how the expression of a material is spontaneously connected with the perception.

If a trained phenomenologist is blindfolded and asked to feel a surface, he will fix his attention on the attributes of pure sensation and abstain from a description of the material from which the object is made. An untrained person, however, will behave in a different way. Given an object to feel while his eyes are blindfolded, he will always answer the question, »What is this?» by saying that it is a piece of stone, a piece of velvet, a piece of wood or some other material. What he is in fact doing is describing the meaning of the tactile sensations he is receiving from the material; the tactile expression of the material. The fact that tactile perception gives the expression of a material does not seem to be a result of indivi-

dual experience or private associations, but seems, from all the evidence, to be a spontaneous and general («inter-subjective») human phenomenon.

The subject will, moreover, very often not only describe the material which has been put into his hand, but also explain how it has been worked or manufactured. He may, for example, state that it is a dressed stone, thus verbalizing his impression of an expression of production. Using his eyes and not his fingers, he may instead use the visual perception of texture as a basis for these meanings. It very often happens that the perception of depth texture is transformed into a tactile image, and becomes in this way connected to the same expression as the corresponding tactile perception. If Fig. 13: 4 is examined, it can be discovered that different objects give different tactile images, and also give immediately images of the materials, stone, wood, horse's skin and so on. The plain texture can, however, be the basis for such expressions of material as well as the depth texture. This

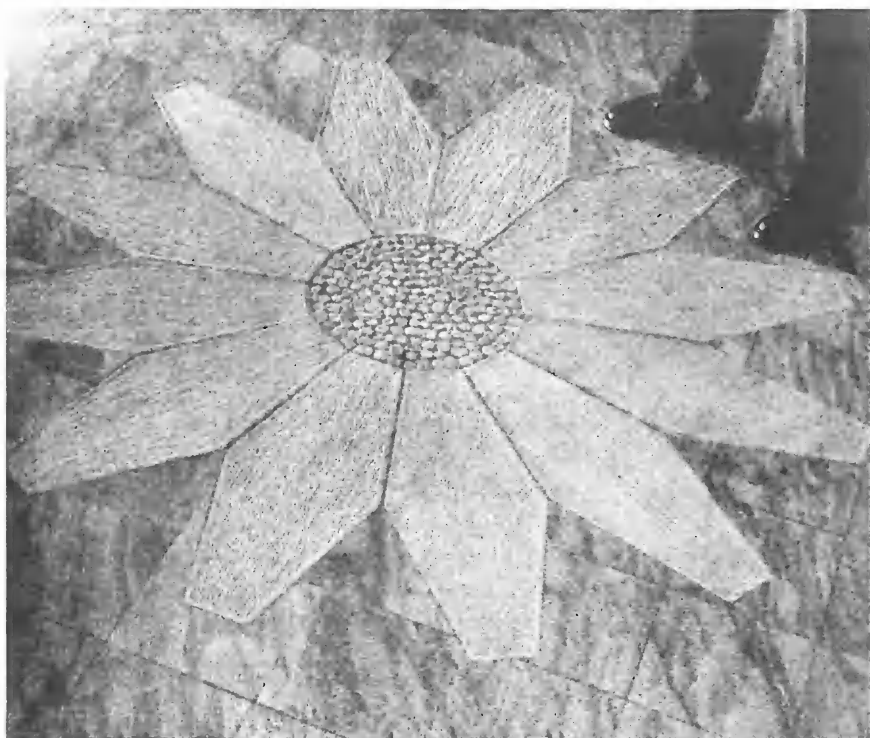
Fig. 17:30. Wood and marble. Photo by Wahlberg.



can be understood from Fig. 17: 30, which shows some pieces of wood, and some pieces of marble. The materials can immediately be recognized from the textures.

A chromatic photographic reproduction can imitate the texture of a material so well that the observer believes he is looking at a real piece of material and not a photograph. Touching the photograph to verify the tactile image reveals the illusion. Such an experience is usually followed immediately and spontaneously by an evaluation, but this can be quite different and depends on the valuation norm. It can either be positively evaluated as "a good piece of imitation", or negatively evaluated as "a false illusion". The positive evaluation is more often given by the professional who deals with these conjuring tricks than by the architect, who has been trained to look for "deeper" logical evaluations rather than superficial aesthetic ones.

Fig. 17:31. Marble floor. Designers, Backström and Reinius.



In the following list of the main material expressions, the role played by visual form will be stressed first, but it will also be indicated how other perception modalities can add their contributions.

Wood. For purposes of building and furniture wood can be used in its natural state. However, many different kinds of tools can be used for cutting and sawing. Fig. 17: 16 shows both the expression of production and the material expression of the wood. Wood can be bowed and, with modern techniques, bent into complicated curved surfaces as shown in Fig. 17: 27. Such production methods permit a good material expression of the wood.

Natural Stone. Natural stone is the most important building material besides wood. It can be used without dressing, or dressed in more and more complicated stages from the rough cutting-out of the rock to the smoothest polishing. These different degrees of dressing contribute much to the expression of the material as can be seen from the Swedish marble floor in Fig. 17: 31.

Leather. Leather is first of all characterized by its high degree of plastic malleability which it acquires through the seaking process it undergoes during manufacture. After drying, it is no longer malleable but keeps the form it has, unless a special process enables it to keep its flexibility. In much sports equipment, such as the saddle in Fig. 17: 4, the visual form has a strong expression of leather.

Ceramic Materials. Ceramics can be manufactured in many different ways, two of which have already been mentioned. Clay can also be used to make bricks, roofing tiles and a variety of other objects. Thus the form of a ceramic object does not always tell us as much about the materials as the colour and texture do.

Metal. Iron is taken as the most typical example of a metal; and forging is the oldest method of handling it. At an early stage objects of iron and other metals were also cast in moulds. Today, perhaps, rolling and pressing are the most important manufacturing methods in use. Fig. 17: 17 shows examples of old methods of treating iron in which the expression of the material is very evident.



Fig. 17:32. Glass objects. Designer, Palmqvist.

Glass. The art of glass-blowing is a very old technique but is still included amongst rational methods of production today. Glass, like metal, can also be cast and rolled or manufactured in other ways. The glass artist strives to express the material he is using. The most important sensations are volume colour (transparency), a stiff haptic form, tactile hardness, smoothness and coldness. Fig. 17: 32 shows some glass objects in which the visual form

plays the role of basis for the material expression. The glass objects come from Orrefors, the well-known Swedish glass factory which has for a long time been engaging artists to find good expressions for the material in which they work.

Textiles. The foremost characteristic of textiles is the intertwining of the weft with the warp. If a printed pattern is applied to a uniformly coloured piece of textile, a bad expression will be given to the production technique as well as of the material itself. The connoisseur therefore evaluates the printed pattern much lower than the woven one for semiotic reasons. A typical, often consciously used indication of the »true» expression is to be found in a slight, stiff angularity in the details of the pattern. Fig. 17: 33 illustrates a masterpiece of modern Swedish textile art by the well-known pioneer Märta Måås-Fjetterström. It is astonishing to find rural work in Africa using exactly the same method for expressing the material but this does in fact support the thesis that such kinds of expressions of material are spontaneous and common even if it is suggested that the Swedish textile artist has been inspired by African art.

Concrete. The materials described up to now have all been used from very ancient times, before the beginning of written history. However, there is a new material in use today, namely concrete, which is becoming more and more dominant and which has, in a certain sense, a relationship to other modern techniques. Modern lorries have developed from the wheeled wagons created by the ancient Egyptians but are built today according to mathematical calculations giving modern life an »artificial touch». In the same way, the precursor of concrete can also be found in ancient times, in the Roman *opus concretum*; and in the same way, mathematical calculations are used when manufacturing concrete today which give the modern milieu an artificial touch in its expression of material and structure.

It has been said that concrete has made possible the creation of a completely new, »organic» architecture. Before discussing this it is necessary to say something of the concepts »organic» and »architectonic».

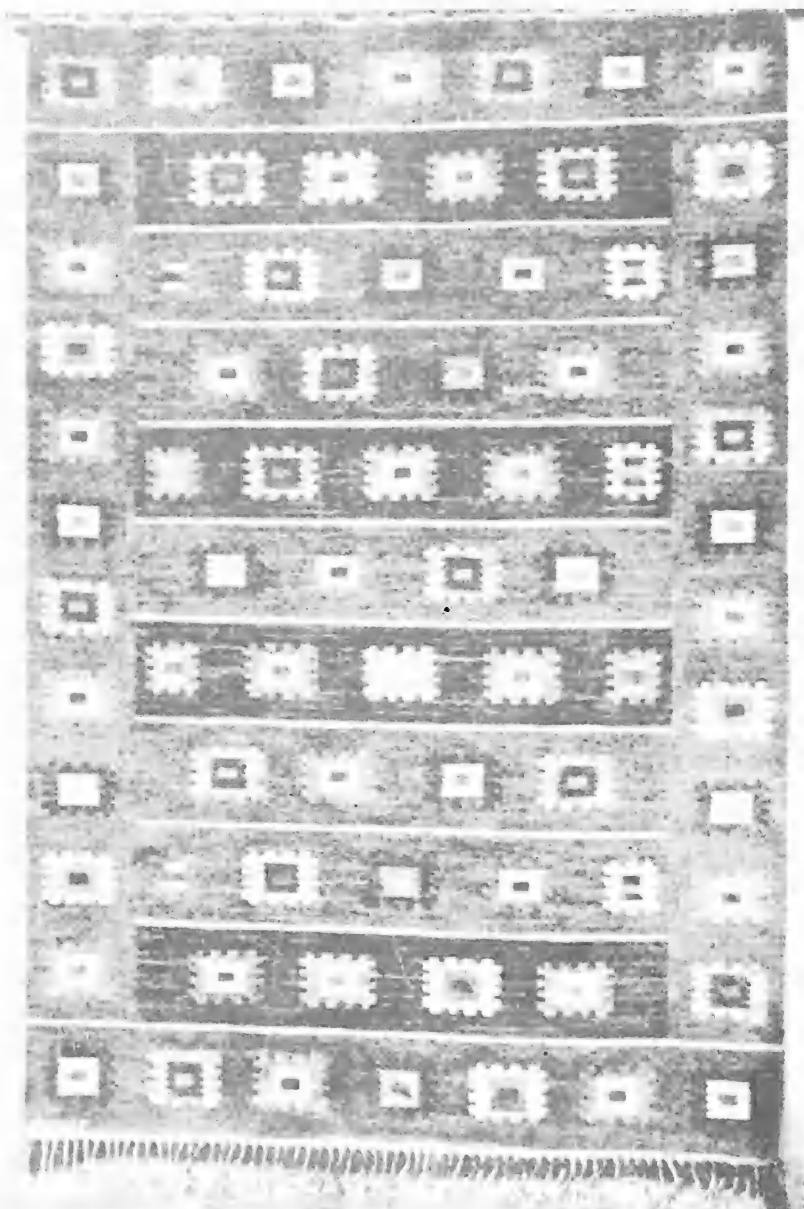


Fig. 17:33. Carpet by Måås-Fjetterström.



Fig. 17:34. Greek temple in Paestum.

A unit or Gestalt, such as a building, or any other object, can be articulated in two different ways. It can be composed of units, details which are defined in themselves, assembled to make a larger unit, as for example in the Greek temple in Fig. 17: 34. This is an »architectonic» form. On the other hand, the articulation can be done in such a way that the details seem to have grown out of a single form, rather like the limbs on the body of a man or the branches on a tree, with no clear boundaries where they meet the main trunk and the body. This is the »organic» form. An example is given in Fig. 17: 35, an airport terminal.

Concrete is evidently more suitable for the creation of »organic» form than any other material, and such forms can obviously express the possibilities of this material and give an expression of concrete. »Architectonic» form can also be created in concrete, however, as the construction of prefabricated concrete elements shows. These forms also give a good expression of the material.

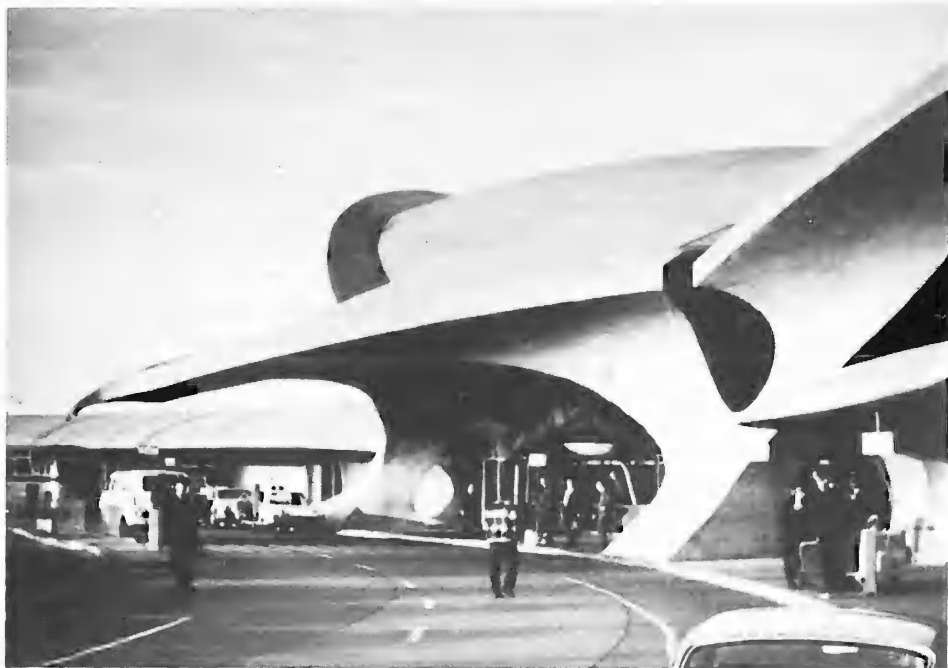


Fig. 17:35. Airport terminal. Architect, Saarinen.

The problem of giving a beautiful expression to concrete is something which must be left to the creative imagination of the individual architect and definite rules cannot be stated.

Plastics. Another group of artificial materials that is being used more and more is the group known as plastics. Technically, there are many different types of plastics, but all show the same architectural difficulty, i.e. the difficulty of giving objects created in this material a good expression of the material. This is possibly a result of their recent introduction, and when further experience has been gained in their use it may be possible to find forms which do give a natural expression to the material. In the beginning, plastic objects were imitations of other forms, but today they are assuming more and more a definite style of their own. This is a material, like concrete, where the young architect and designer has to make his own individual contribution.

Man's Need for Architectural Expressions. — The question can now be taken up: "Do we need to experience the architectural expressions discussed here?" I will try to give an answer to this question.

To begin with I will repeat what I have said already, namely that these expressions give information about the external physical world, information which is often necessary for our survival. But when human beings are aware of their perceptions, they become interested in them without any thought of their practical function. The perceptions begin to live their own lives separately from the information they may give. People begin to »look« at their perceptions, study them and evaluate them positively or negatively as purely mental entities. This attitude is called the aesthetic attitude. When doing this we distinguish between the »formal« aesthetic evaluation of »pure« sensation or perception (where we do not take the meanings or emotional loadings into account), the evaluation of meaning, and the appreciation of the emotional loading (the emotional expression). And the positive evaluation of the architectural expression is definitely dependent on its veridicality. If a test verifies that the expression is »true«, then we may evaluate it positively. However, this kind of evaluation may often be overruled by other evaluations of other elements in the perception, and some training seems to be necessary to achieve the sensibility needed.

Once again a question crops up: Why should we train our ability to evaluate architectural expressions? The answer is that if we are living in an "honest" environment, an environment where the appearance of the objects tell us "honestly" about their purpose (function) and the way in which we have handled them (that is when they have production and material expressions), this will influence us in such a way that we ourselves become more eager to be honest in our behaviour. This is not something that has been experimentally checked, and I doubt that it will ever be possible to make a relevant experiment, so you may just take this as the author's opinion, based on a long life of experience.

IV EMOTIONAL LOADINGS

18 The Role of Emotion in Perception

The nature of the aesthetic evaluation has been judged to have many different forms during the history of the theory of art and architecture. The original and very naive idea was that "beauty" was the property of the physical object itself; and later on, "beauty" was regarded as an attribute of the perception, comparable to "round" or "yellow". In the literature of architectural theory, it has been assumed from the beginning of this century that "beauty" is an "aesthetic feeling" which could be aroused by a perception. This "beauty" should thus be equivalent to "pleasantness". Finally, however, as has been made evident in the previous analysis, "beauty" is an evaluation judgment which can be given to a row of psychic entities, including feelings and emotions which can have been aroused by a perception.

Therefore, according to what has been said previously, we may assume that what we evaluate, and especially what we evaluate from an aesthetic point of view, is a complex entity in which a number of sensations, images, expressions and emotions are connected to one another. However, the laws that govern the making of these connections are not yet known in all their details. We do know that our emotions almost always »colour« our images and perceptions, but we do not yet know exactly what role these emotions play. This is to a certain extent because systematization in the realm of emotion psychology is still incomplete. In the following I will give a brief survey of the commonly accepted principles.

Feeling, Emotion and Sentiment. — "Feeling is what we call our mental life when it becomes conscious as pleasure or pain". This definition given by a Swedish psychologist agrees fairly well with habits in language. In both Swedish and English, we speak of feelings of pleasure or of pain, and it is because of this, that in every language the two extremes pain-pleasure have been given the name *feelings*.

The word *emotion* is used especially for the indication of fear, anger, joy, sorrow, or nuances of these. In addition to these *basic emotions*, there is an almost unlimited num-

ber of secondary, acquired, highly complicated systems of emotions and impulses, that are usually called *sentiments*.

However, no clear distinction between these concepts exists, and none will be made in this book. The word *emotion* will nearly always be used according to the habits that are becoming increasingly general in the literature of psychology.

It has already been stressed that our emotions play an important role in our evaluations. It is our emotions which touch, move, affect, or impress us, and so on. What is experienced as pleasure is, therefore, often given a positive value, while what is experienced as pain is nearly always evaluated negatively. From this point of view, in accordance with the Evaluation Nihilism Theory, it might be said that the emotions of pleasure or pain are our subjective, involuntary and immediate evaluations of our experiences.

Even if it might, in consequence, be possible to believe in a certain tendency towards a positive evaluation of pleasure, examples can be given to show that this is not an absolutely general rule. In dramatic art in particular, pain can be used for artistic or aesthetic purposes. And for religious or moral reasons the pleasure of looking at gay colours can be given a negative value. From these and other examples, then, it may be seen that pleasure and pain can sometimes be given positive values, and sometimes negative values.

System of Emotions. — Attempts to systematize the emotions have been made according to several different principles. The primary division, pleasure-pain, has already been mentioned. Other bases for division can be found in excitement (agitation-tranquility), duration (life-long affection-sudden passion), depth (shallow pain — deep sorrow), origin (innate biological reaction — acquired emotions), and according to the object of evaluations.

Attempts have been made to demonstrate the different »dimensions» of an emotion diagrammatically in a way similar to that which we have found to be useful in the realm of sensations or »basic perceptions», but these

attempts are not nowadays accepted by our psychologists. Other methods of systematization have been tried, however. Shand talks about simple *emotions* on the one hand, and more complex units which he calls *sentiments*, built up from the simple emotions, on the other. According to Shand, one can among the emotions observe a number of *basic emotions*, namely fear, anger, joy, sorrow; and *primary emotions*, disgust, repugnance, surprise, curiosity. No detailed description of the criteria that a feeling must fulfil in order to be classified as such an emotion will be given here, as those interested can consult Shand themselves. What will be emphasized here is the fact that the emotions themselves seem to build a series from the basic and primary emotions to what Larsson calls *sensorial emotions*.

These sensorial emotions are the ones which are first awakened by a sensation or perception and are often difficult to distinguish from this sensation or perception. This is why a sensation attribute and an emotion are sometimes indicated by the same word in everyday language, as in the following example.

A colour composition containing large colour intervals may well produce an emotion describable as "brutal". If a composition contains small colour intervals and light pale colours instead, it may well awaken a feeling of "deliciousness". Brutal and delicious here make a pair of concepts which do not seem to indicate anything other than emotions. But if one of the compositions contains a preponderance of intense, yellow-red colours, and the other a preponderance of brilliant blue-green colours, an artist will describe the first one as "warm" and the second as "cold". He may never be able to understand that these attributes "warm" and "cold" can only refer to tactile sensations. To him, the colours *are* warm and cold. But since the one which is warm does not burn an observer and the one that is cold does not freeze him, such words cannot be used to designate an attribute of colour. They must therefore be the names of the emotions which follow from or are connected with the perception.

How is it that these designations can be borrowed from the names of attributes within a completely different

perception modality? It has often been said that this depends on private associations. There is allegedly some awareness that a hot fire is yellow-red and cold ice is blue-green, and the associations of these irrelevant concepts have been drilled into the head. However, Kaila draws attention to the fact that private associations are fairly loose, and easily destroyed. But there are some connections which are so strong as to be virtually indestructible, and this would seem to indicate connected structures between the realm of (visual) colour and (tactile) temperature. Such an analysis indicates a sensorial emotion which could perhaps be called the »temperature» emotion.

Such connections between structures of different perception modalities have been described in Part I of this book as transformation tendencies, and these transformations can now be seen to be followed by certain sensorial emotions which cannot themselves be experienced without the foregoing sensation or perception.

Meaning and Emotion. — The fact that giving a meaning to a visual form Gestalt can connect this form to an emotion has been mentioned earlier. (See, for example, the drawing »My Wife and My Mother-in-law», in Fig. 1: 4.)

Another example is provided by the sound of the word »love». This sound, like all words, has a meaning. Without such a meaning, the word »love» would merely be a cry and not a word. Nevertheless, there is now a tremendous complex of emotions connected to the meaning of the word »love».

It can be said, without exaggeration, that the emotions almost always play a role in every phenomenological experience. These emotions play their role both in unconscious evaluations and in the perceptions themselves, as well as in the images. In the following, some examples will be given of the manner in which emotions are connected to perceptions, beginning with an example which shows very clearly how the meaning of a perception can function as an intermediate link between the perception and certain emotions.

In 1498, Dürer made a drawing of an armed knight on horseback, Fig. 18: 1. His intention is evident from a note on the drawing, »this is what arms were like in Germany at this time«. Neither the rider nor the horse show any special expression of emotion, but it can, on the other hand, be remarked that the carriage of both the man and the horse indicate a certain listlessness, which is the equivalent of the artist's listlessness to emotional connections while he was making the drawing, as it was only the study of the armour and weapons that interested him in this particular drawing.

Some time later, Dürer took this drawing, combined the rider with a slightly different or changed horse and placed both against a black background, Fig. 18: 2. In this drawing, the rider appears to draw himself up, giving his former listlessness a trace of frankness. This gives the original study of clothing and arms a slightly changed meaning which is now connected to strong emotions. »The German rider, on his powerful horse, rides alone and fearless through the black night.« The black night is later changed to a threatening landscape, peopled with the Dead and the Devil, Fig. 18: 3, and by means of this,



Fig. 18:1. Dürer's armed knight on horseback, Fig. 18:2. Some slight changes.

the meaning of the drawing has been deepened until it has passed into the realm of the religious.

By making some slight changes in the original study of clothing and arms, and adding a background, Dürer succeeded in getting the *different* meanings of the different parts of the composition to form a *fusion of meanings* which awoke now emotions and sentiments earlier present only as latent possibilities. In this example, the meanings have mainly been representations. In architecture other kinds of meanings, the architectural expressions, are used instead, and it is the architect's task as an artist to create architectural expressions with emotional values.

Perception and Emotion. As has been shown in Dürer's picture, an emotion can be connected with a perception by the use of meanings. It can also, as has been pointed out with reference to the sensorial emotions, be connected directly to a perception. Modern artists are very interested in finding spontaneous connections of this kind, and this is also a fascinating problem for architects.

Before going into any more detailed analyses, however, a few words must be said about the difference between a sensation or perception, and an emotion. Four criteria are usually given:

1. Contrary to the perceptions, emotions are not localized in the body. They exist in human minds, but not in any definite part of the body. On the difference between sensation and emotion, Larsson stresses that »any experience, which is localized in the body, be it in one particular place, or in the whole body«, ought to be counted as a sensation. Thus an emotion is not in the fingers, the head, or any other part of the body, or even in the body as a whole, it is localized only in the mind.
2. Perceptions can often be analyzed into simple sensations, and the attributes of such sensations can also often be analyzed. Emotions, however, do not consist of parts which can be studied separately, and do not have any structure similar to the structures already found in the different perception modalities. They are phenomenologically diffuse entities.



Fig. 18:3. The rider riding through the threatening landscape.

3. The emotions are — more than the perceptions — experienced as something subjective and something which grasps the total personality. Intimately connected to a sensation, an emotion often occurs in the subject's consciousness. Nahlowsky states that »the sensation is the cry of which the emotion is the echo«. Larsson adds, »One can say that the emotion is the reaction of the consciousness to the emphasized sensation«.

4. The attributes of a *sensation* can be the objects of *introspection*. Such is not always the case with an emotion. Attempting to study emotions by means of introspection usually results in the emotions changing and often disappearing. The best way of studying emotions seems perhaps to be using behaviouristic methods.

To summarize, it may be said that the science of experimental psychology has up to now been unable to discover any proper way of studying the nature of the emotions. The student will have to be content with more speculative ideas.

Privately Associated Emotions. — The emotion connections discussed up to now have been based on the "inter-subjective" structure of the human mind and have therefore a general validity. However, it must not be forgotten that in an actual situation other connections between perceptions and emotions can occur, based on private and highly individual associations. Thus it can happen that when a person, or a group of people, have at the same time had some particular disagreeable experience in connection with a certain colour, then this colour can easily give rise to a memory, possibly unconscious, of the disagreeable event, and so connect the colour in question with very unpleasant feelings. Such *privately associated emotions* are, of course, of very great importance in individual life.

But such more or less accidental, and sometimes quickly disappearing, associations cannot of course be the basis for any universally applicable architectural theory, and are not in this context of much interest here, however important they may be.



Fig. 18:4. "The weeping madonna". Painter, van Dyck.

Expression of Emotion. — The following analysis is given in order to clarify the manner in which the expression of emotion operates in painting. It will make it clear that these kinds of emotional expressions cannot in fact be found in architecture.

Fig. 18: 4 shows van Dyck's¹ painting, »The Weeping Madonna» which has a strong expression of sorrow and tribulation, and these emotions are very well indicated. The painting is representing a human face. Fig. 18: 5 is Sørensen's² »Asia», in which the artist makes clear that the painting consists of paint applied to canvas with a brush — this is the material and production expression of the painting. At the same time, while a displacement of meaning has taken place, the emotional expression has intensified and the painting no longer expresses submissive suffering but violent despair.

Fig. 18: 6 shows a study for the great monumental painting "Guernica" by Picasso.³ This study cannot be said to be a realistic representation of a human face. Formal elements, strokes and points, have begun to dominate and the emotional expression is thus raised to a bursting point of death-agony.

1) van Dyck, Anthonis, Flemish painter, 1599—1641

2) Sørensen, Henrik, Norwegian painter, 1882—1962

3) Picasso, Pablo, Spanish painter and sculptor, 1881—1973



Fig. 18:5. "Asia". Painter, Sørensen.



Fig. 18:6. "Guernica". Painter, Picasso.

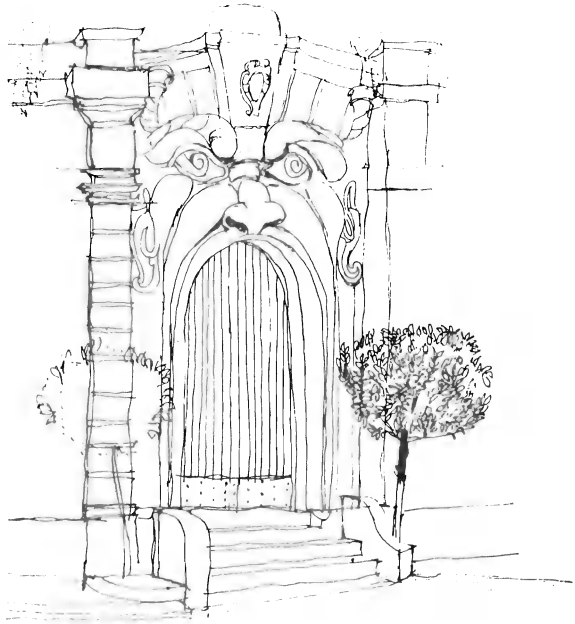


Fig. 18:7. Baroque building in Rome.

It should be noted here that if the obliteration of the naturalistic representation was carried one step further, all resemblance to a human face would disappear and the emotional expression would be weakened and limited. Nothing would be left except a composition of points, lines and colours, which might well describe a violent emotion, but which would give no indication of what kind of emotion it was: joy, anger, fear or sorrow. In this manner, the »deep» basic emotions would not be expressed, and only the sensorial emotions would be left. This is in fact what happens in architecture. The attempt to catch an emotional expression in the baroque building in Rome, Fig. 18:7, cannot be regarded as good architecture.

19 The Latent Character of the Connection between Emotion and Basic Perception

Attempts have been made in experimental psychology to clarify how emotions are, or can be, connected to "basic" perceptions, i.e. perceptions without meanings. It has first of all been found that certain emotions are latently connected to certain perceptions. Under different circumstances, different emotions can be made manifest by one

and the same sensation. Of course, emotions which are not latently connected to a certain sensation cannot become manifest by means of that sensation. It seems that the sensorial emotions are more easily made manifest by sensations than are the »deeper» emotions, which need to be supported by cooperation between several sensations being present simultaneously. With regard to the »deepest» emotions, especially the »basic» emotions, a »pure» or »basic» perception is evidently insufficient to make them manifest — a meaning is necessary as an intermediate link, as was seen in the previous chapter.

As far as the sensorial emotions are concerned, the different perception modalities have their specific emotions, and these are normally strongly coloured by their perception modalities. Sometimes, however, particular sensorial emotions can be common to two or more modalities, by means of the transformation tendency, or, to put it more correctly, those emotions which are common to several perception modalities create the basis needed for these transformations to appear. These sensorial emotions also build the skeleton of the affective continuum described by Hartshorne.

The Emotional Connection to Visual Form. — The attributes of the visual form sensations have already been described in Chapter 3, where the different characters of two sensations separated by a pregnant attribute have also been mentioned. It might perhaps be said that character and sensorial emotions are synonyms for the same concept. The following analysis of the polar extremes »open-closed» might clarify this.

Fig. 19: 1 shows a closed, a half-open and a wide-open form. These words describe fairly well the attributes of the forms shown, but are not absolutely free from subordinate emotional senses. »Being closed» and »being open» are not only attributes of form but are also designations of the human character. An »introverted» person is referred to as »closed» while an »extroverted» is said to be »open», and they are governed by different emotions or sentiments. Joy plays a more predominant role for the »open» than for the »closed» person. It may therefore be said that the visual form attribute »open» has a



Fig. 19:1. Closed, half open, wide open.

certain rather vague connection to a *basic emotion*, a connection which can be strengthened if other connections are added. A colour and a meaning can be added to make the wide-open form a warm, yellow flowercup, and in this Gestalt the sense of »joy» has a much more definite expression.

Another example of a connection between a perception and a *primary emotion* is given in Fig. 19: 2. After looking at this figure steadily for a short time, it will be found that the original feeling of slight uneasiness deepens to one of disgust or repugnance. A wallpaper with this pattern was once used by the author at an exhibition for demonstration purposes. The man whose job it was to hang the paper could not finish the job as his repugnance became so pronounced that he was forced to go home to bed.

Figs. 19: 3 and 19: 4 give examples of the ways in which a connection to a sensorial emotion can be combined with a transformation tendency from one perception modality to another. Fig. 19: 3 shows a bedroom interior with soft furnishings, and some pastries. The visual perception of this room with its glossy silk textiles and general air of depravity has a tendency to awaken an image of something insipidly sweet, an image similar to that of the perception of the pastries.

Fig. 19: 4 shows another bedroom with a different character, and a piece of rye bread. This time, the visual perception of the room gives you an image of something harsh or grating, just like the image you will have from the perception of the piece of rye bread.

What is evidently common to the two visual perceptions in Fig. 19: 3 is an emotion of »sweetness», and in Fig. 19: 4 an emotion of »harshness». These emotions thus have no autonomous names, they have borrowed their names from the world of perception and are to be looked upon as *sensorial emotions*, but »deeper» in mind than the sensorial emotion polar extremes of »open-closed», just described. They are on the borderline between sensorial emotions and »free» emotions, and very nearly indepen-



3, 19:2. *Look at this figure steadily for a minute!*



Fig. 19:3. Bedroom and pastries. (After Jurvis.)



Fig. 19:4. Bedroom and rye bread. (After Jarvis.)

dent of sensations. A taste, a smell, a colour, a form, can be »sweet«, but the *meaning* of a visual perception can also be »sweet«; a girl can, for example, be described as »sweet«. Similarly, »harsh« can in the first place be a synonym for a rough grain, it can also depict a visual form, and it can also indicate behaviour, in which case it is independent of any perception.

The Emotion Connections to Colour. — In his experimental work with colours, von Allessch was primarily interested in the formal aesthetic problems which were described in chapter 4. He also made some experiments on the connections between emotions and colour sensations in which he used both single colours and pairs of colours. These experiments were carried out in such a way that his subjects, when perceiving a colour or pair of colours, described not only their aesthetical evaluation but also the emotions which were aroused in them.

At first, von Allessch tried to carry out these experiments with single colours filling the whole field of sight. He immediately found, however, that the only emotion which occurred was one which could be described as "overwhelming". It was necessary to arrange the experiment so that the colour in question was perceived as the colour of a figure against a background of some other colour, thus providing an example of how colour and form sensations combine to create a total visual perception.

Only after some practice were the subjects able to detect emotions connected to the colour sensations without any intervening link of meanings. A regularly repeated experience was the finding that "educated" subjects could more easily produce a formal aesthetic or emotional aesthetic evaluation than "uneducated" subjects. The "uneducated" person always looks for the semiotic value, the meaning, while the "educated" person can more easily adopt the analytical attitude necessary for detecting the emotional connections. From the mixture of spontaneous emotion connections, and ". . . associations in more traditional meanings" — that is, accidental, privately connected entities — von Allessch believed he was able to draw certain conclusions, the most important of which are as follows:

1. Grey seems to be relatively free from emotion connections.
2. Among emotions connected to chromatic colours, certain polar rigt extremes are of special interest, notably activity — passivity, intensity — detensity. heavy — light, warm — cold, strong — weak, and some others.

When the phenomenon of transformation tendency was described, examples of connections between sensations and emotions were given. The transformation between colour and temperature, which might be called the temperature emotion, was also mentioned. To complete the investigations made by von Allesch it is now necessary to refer to some experiments made on the transformation from colour to temperature, basis for the emotional polar extremes warm—cold, and on the transformation from colour to weight, basis for the emotional polar extremes heavy—light.

Chandler refers to investigations made by several researchers. The result of these experiments, and also of these of von Allesch, is that light colours are experienced as being light in weight, in contrast to dark colours, which are experienced as heavy. There seems to be no exceptions to this rule. The experiments made, like those of von Allesch, also show that colours »are» warm or cold, and that the extremes of this sensorial emotion are strong yellow-red and pale blue-green.

Warm—cold, light—heavy, and perhaps also active—passive, are examples of transformations which function as basis for connections to sensorial emotions. It has been found that the polar axes of these sensorial emotions do not always coincide with the structure of the colour perception modality.

Emotion connections, or emotional loadings, have also been the subjects of recent studies using the method of »semantic differentials». A brief description of this will be given in the next chapter.

Emotions Connected to Attributes of Light. — The perception of light and illumination seems to be more directly connected to the basic emotions than any other perception modality.

The most important attributes of light perception are: direction of light, shadow, (perceived) light intensity, and colour of light. The expression of joy in a painting can most effectively be supported by the illumination being from above. From this direction, light is most easily connected with sentiments of hope and optimism. Light from below, on the other hand, seems to have latent connections with the sentiments of foreboding and pessimism.

When the sun is shining, a strong shadow is created and this is immediately connected to happy feelings. When the sun disappears behind a cloud, the light becomes shadowless and this is associated with feelings of depression and gloom, possibly even melancholy. Fig. 19: 5 and 19: 6 give examples of this.

The shading of an object can to a very large extent stress the plasticity of the visual form (see Chapter 3, visual Form, where light and shade are mentioned as one of the factors for the perception of depth). This perception of visual form has a tendency to be transformed into an image of haptic form and it is this image which requires to be verified later. Here it should merely be stressed that this tendency towards activity is combined with feelings of happiness and eagerness, and perhaps also with wrath or anger. On the other hand, shadow-free illumination is connected with sentiments where sorrow and joy are combined, as in sweet melancholy or tender sadness.

With regard to perceived brightness or light intensity, strong light is apparently connected to realism and clarity, while weak illumination is combined with mysticism and fear. Joy, full of eagerness, or anger, (aggression) is connected to realism; woeful joy (melancholy) to mysticism. Strong illumination and plastic shadow therefore cooperate as do weak illumination and a lack of shadows.

There is thus greater coincidence between the structure of attributes and of emotion connections in the perception modality of light, than, for example, within the realm of colour. It has also been demonstrated that the emotion connections to light perception do not stop at the sensorial emotions but penetrate deeper to the basic emotions.



Fig. 19:5. Sunshine, strong shadows, happy feelings. Photo by Pleijel.



Emotion Connections to the Total Visual Field. — The emotion connections to a colour are dependent not only on the attributes of the colour, but also on where the colour is situated in the visual field and the kind of form that the colour fills. It is therefore necessary to discover the connections between certain emotions and the total organization of several particular fields of perception.

The first objects of our study will be the simple picture by Petersen shown in Figs. 19: 7 and 19: 8. Petersen makes the following remarks about Fig. 19: 7, »The darkness opens itself. Symbol for the light. Optimistic atmosphere.» The first condition that is required to make this possible is that the darkness is perceived as a figure with a hole in it through which the light background behind the figure can be seen.

The same applies to Petersen's next picture, Fig. 19: 8. His own comments are, »The darkness assembles. Symbol for pressing darkness. Pessimistic atmosphere». If the darkness is perceived as a background seen through a hole in the light figure, something threatening is experienced where fear and sorrow both exist. Sitting at night in a lighted room and looking out into the night provides the same experience, and one is happy to remain in the room instead of having to walk out into the dark night. Lightness and darkness can, however also be distributed in other ways.

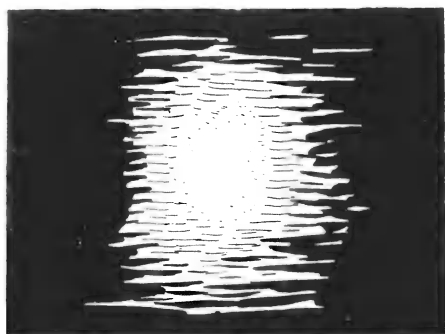


Fig. 19:7. *The darkness opens itself.* (After Petersen.)

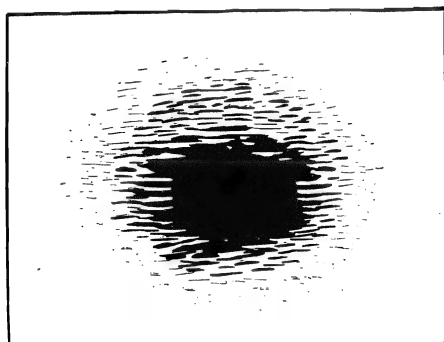


Fig. 19:8. *The darkness assembles.* (After Petersen.)

Rubin has found experimentally that when a visual field is divided horizontally there is a tendency to perceive the lower part as an object or figure while the upper part is perceived as background. (That is, if no special circumstances are present to change such an experience.) If the upper, background, is dark, and the lower, figure, is light, then the same phenomenon occurs as is described above for a light object seen against a dark background. In the same way the first phenomenon described above occurs when there is a light upper part against a darker lower part.

What is of interest is therefore not actually which geometric part of the field is light or dark; it is a matter of figure and background. I have no intention of going into the details of the theoretical problems of painting here. Enough has been said to demonstrate the complicated nature of the connections between the total visual field and the emotions. They must be studied individually, case by case.

The emotional loadings of other perceptions modalities will not be discussed here. Those who are interested in this should refer to my book *the Language of Architecture*.

20 Semantic Differentials

About ten or fifteen years ago a method was developed by Osgood for tracing the features of an experience, like listening to, or reading, a word. He coined the term "semantic differential" for this method. The procedure can be described as follows. A subject is asked to compare a certain concept, like "father" or "USA", with some pairs of words. In each pair, one word is positively, and the other negatively, loaded with emotion, evaluation or any other kind of "meaning" (This is Osgood's terminology; O. does not use the concept "meaning" in the same restricted way as in this book). One thus obtains a description of the "dimensions" of the emotions, preferences, etc that are associated with the concept. And if all subjects have the same associations we might apparently begin to discuss some kind of consensus. This method might well be used for perceptions as well as for abstract concepts. It would then be possible to analyze the dimensions so de-

tected by means of what is called "factor analysis". Osgood's own factor analysis shows that the most important factors are the evaluations. He has also tried to analyse these evaluations in more detail. Thus he gives a report on a factor analysis showing that some other sub-factors can be detected within the more general factor "evaluation". Osgood describes the situation with the general evaluation as "a sort of sheath with leaves unfolding towards various other directions in the total space". These detail factors are described as "morally evaluative", "aesthetically evaluative", "socially evaluative", and "emotionally evaluative". Except for the moral evaluation, which is not relevant to architectural theory (unless one thinks of this as equivalent to my "architectural evaluation"), these factors are the ones discussed in this book. However, I have by introspection extended the analysis achieved and I think one can say that these "semantic differential scale" judgments, in combination with factor analysis, can well be used to verify — or perhaps to deny or modify — the results of an analysis based on introspection and phenomenological analysis, but they cannot be as varied and detailed as this latter analysis.

I would also like to draw attention to the fact that what Osgood is measuring is not the meaning of the concepts examined, into the way »meaning» is understood here; it is something else. It is of course true that the subjects in his experiments combine concepts with words, but they do not put a sign of equality between concept and word. What they are doing is saying that there is something in the concept that is similar to something in the word, and this »something» is some kind of emotional loading, often of the type that Larsson has called sensorial emotions. To make this more clear I refer to Fig. 20: 1, a figure shown by Köhler to his subjects with the following question: »One of these figures is called 'malumma', and the other 'takete'. Which of these names belongs to the figure on the right, and which to the figure on the left?» It has been shown experimentally that the majority of people answer in the same way. The round figure is called "malumma" and the angular one "takete". In this case it cannot be said that the round figure *gives rise* to a conception of the word "malumma", nor that "malumma" gives rise to a conception of a round figure; but when the two percep-

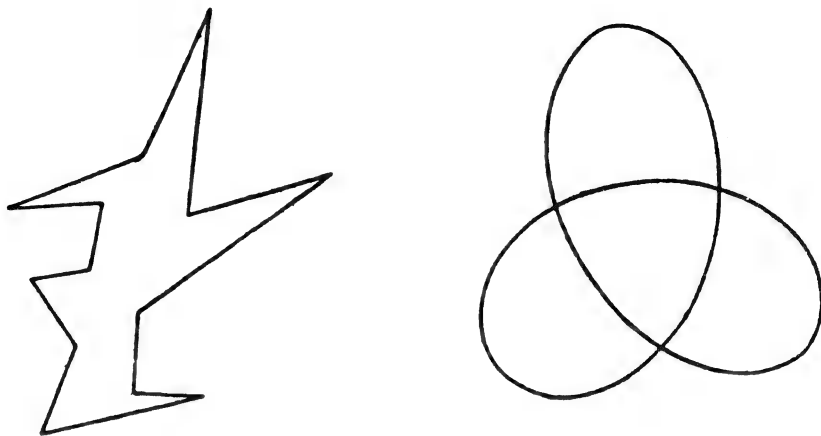


Fig. 20:1. *Malumma and takete.* (After Köhler.)

tions, visual and auditory, are confronted, they are found to *suit one another*. The two "nonsense forms" (forms without meaning) are combined with the two "nonsense words" "malumma" and "takete" (words without meaning). What is "measured" here cannot of course be a meaning (in my use of the concept) since there are none; it must be looked upon as a sensorial emotion. In order to demonstrate how the method of semantic differentials can be applied to the realm of study in which we are interested, I excerpt the following (with his permission) from Lars Sivik, a Swedish psychologist who has carried out a series of experiments with colour in order to find the relation between the emotional loading of colours and the attributes of these colours expressed in NCS.

Later on I will give a brief description of another application of the method of semantic differentials, namely when talking about preferences for different townscapes.

EXCURSUS

Colour Connotations and Perceptive Variables

by Lars Sivik

(Excerpt)

Since the beginning of time colours have had significance as symbols of different phenomena. To many people, from prehistoric time all the way to our own days, colours have had mysterious meaning and power. They

belonged to the supernatural, to the very question of life and death. A review of history shows clearly the metaphysical and thereby also the psychological importance of the colour experiences. The connection between colour and moods, affections and associations, is, and evidently always has been, looked upon as something concrete, something we ought to be able to study — even if we do not have to regard the phenomenon as supernatural today.

It would be valuable to know how similarly we experience emotionally different colours. Do we generally agree with those who create our environment and apply colours to the objects surrounding us? What colours please us in hospitals, waiting-rooms and places of work? What colours appeal to us in certain situations? If we can, as a basis for making decisions, achieve information which is a little bit better than mere guesswork, then we are undoubtedly making progress.

During the latest decades investigations have been carried out regarding the connotative aspects of colour perception, that is to say the emotional loading of colours. It has for instance been shown how different colours are connected to various extents with concepts like warmth, tranquility, femininity etc.

Possessing a reliable colour-ordering system (NCS), we are now equipped to determine the eventual covariations between dimensions of emotional loadings and colour variables. Since colour, in its very meaning, only exists as perception, the use of a perceptive system is essential for this purpose. A systematic model, built upon a phenomenological analysis of the colour perceptions in the way most people experience them (NCS) will thus be our starting point.

Objectives. — Starting from NCS, Natural Colour System, this study is intended to

- a) investigate whether there are any systematic differences in the emotional loadings of different colours,
- b) map out the covariations between semantic variables and perceptive colour variables as correlations; and in

more detail, graphically with isobars in the colour system-atic model,

c) show, with the above mentioned method of presentation, possible differences, between two nationality groups, namely Greeks and Swedes.

Using factor analysis we can thereafter try to reduce the qualities of meaning into more general semantic dimensions.

The Investigation. — The colour stimuli used in the investigation were 71 colour samples chosen in order to obtain optimal representation of the perceptive variables: whiteness, blackness, yellowness etc. The samples were rectangular 7.0×10.5 cm. Judgements were given individually in a light-insulated box with neutral gray walls. The illumination was CIE Standard source C, with the angle of light entry 45 degrees and the observation angle 90 degrees.

Each colour was judged by 26 subjects (in total 168 ss). The instrument used was »semantic differential scales». This method means that for each concept (in this case each colour sample) the subjects are to mark its position, spontaneously felt, along bipolar semantic scales such as warm-cold, active-passive, etc.

Example: The scales had seven steps. The pairs of opposites were chosen partly according to how commonly they occur when describing colours and partly in relation to their unambiguousness. The number was limited to 26, which was, however, enough for the purpose. Each one of the subjects judged 11 samples against each of the 26 semantic scales.

Results. — As in earlier investigations of this type the statistical analysis of the results shows clearly that systematic differences between colours, in how they are judged against the semantic scales, do in reality exist. This fact, namely that people are sufficiently concordant in their connotative experiences of colours, is a prerequisite for the further study of this question. The personal judgements can be compressed into mean values for every colour (71) in relation to every scale (26). These mean values (1846) have been analyzed according to the

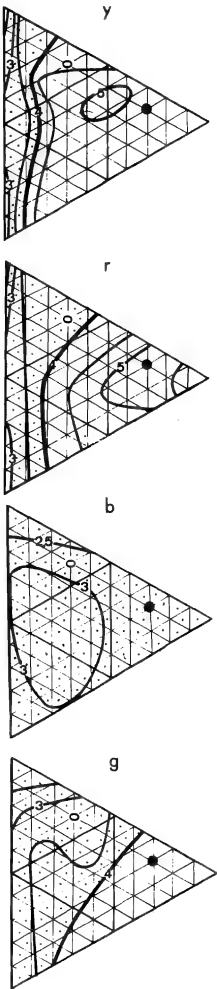


Fig. 20:2. Variation of cold-warm within the hues y, r, b, g.

systematic covariations of every particular semantic scale in comparison with the above mentioned colour variables, as well as with the variable »experienced lightness».

A perspicuous illustration of these connections has been achieved by plotting the average value of each colour sample for every scale into the graphic NCS model. By interpolating between these values one can draw isobars which indicate how different colour areas vary concerning loadings of the semantic variable in question (see Fig. 20: 2). The stimulus material used allowed four different isobar-diagrams for each scale, one for each of the primary hues y, r, b, g.

Using the isobar-diagrams it is now also possible to show how the emotional loading varies with the hue-variable — the hues compared at specified and therefore comparable colouristic positions, implying that the other perceptive colour variables are kept constant. Neglect of this has been the most common mistake in earlier preference and association studies. The continuous line in Fig. 20: 3 shows the group's judgements of warm-cold for different hues, all with a chromatic amount of 70% and blackness of 10%. The dotted line shows the variation for the position chroma 30% and blackness 10%.

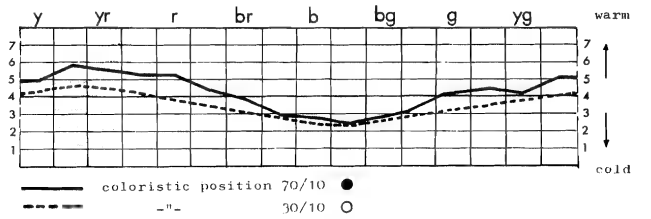


Fig. 20:3. Variation of cold-warm along the hues.

The task will now be to try to analyse how the different scales vary within the colour triangle and between hues. There are obviously differences in the patterns between different scales and sometimes also between different hue-sections for the same semantic scale. Some of them show a very distinct character of pattern with short intervals between the isorars, while others are relatively uncharacteristic, with few isobars, that is, little difference of emotional loading between different colour areas. The variation in frequency of isobars between semantic scales should be interpreted as their different relevance in connection with colour experience. Thus the scale "glaring-subdued" has a difference between highest and lowest group-mean of 4.8 units (out of 6 possible) while the scale "security-anxiety" only covers 1.7 units.

Conclusions. — The present investigation can be said to be a direct and practical application of the perceptive colour system NCS. Its fundamental parameters (degree of similarity to the six basic colours) are easy to understand, and have in the results of this study proved to be relevant concepts. The graphical method used for presenting the results, with isobars indicating equal emotional loadings, gives as shown different isobar-patterns for different aspects of emotion. It can now in theory be supposed that every individual has his special isobar pattern in his attitudes towards colours — which varies depending on the individual's current mood.

Before we begin to deal with the special problems connected with this imaginary model we have tried to show average structures for groups of people.

One of the advantages of this graphical method of presentation is the possibility of comparing emotional loadings between different hues, while the other perceptive colour variables are kept constant. Through this comparison it has been revealed that many variations of emotional loadings which have earlier been considered as depending on differences in hue have in fact arisen because the compared colour samples have also been different with regard to the chromatic amount, whiteness, and blackness. This

phenomenon is most clearly shown in the scale active-passive where all colours on the same »colouristic level» have been judged as being of the same degree of activity.

Excursus Finis

21 System of Evaluations

Up to now, we have discussed three different categories of experience which are evaluated aesthetically.

From the beginning, we have noted that the perceptions themselves can have different formal characters, depending on how they are situated according to the structure of the perception modality in question. The formal aesthetic evaluation is given according to this character. The character depends on our own mental structure and seems to be as stable as the structure of human beings itself. The evaluation, on the other hand, is dependent on an evaluation norm which can vary according to the total pattern of behaviour established within a given culture. Despite this, it has been possible to observe a tendency towards a spontaneous high aesthetic evaluation of some pregnant phenomena.

Later we have stated that the Gestalten, especially the visual form Gestalten used in architecture, have certain *meanings* spontaneously given to them. It was found that these *architectural expressions* were somewhat different from the other kinds of meaning, signals, symbols and others (the symptoms for instance). This kind of meaning is given a *semiotic evaluation* and it has been demonstrated that such an evaluation can be strongly spontaneous and stable. It was found, however, that there is a certain connection between techniques and semiotic evaluations which enabled new techniques to give rise to at least new modifications of the spontaneous meanings.

It was finally stated that a perception can be connected to an emotion. In talking of the perception of human beings or pictorial representations of human beings, the words »*emotional expression*» are commonly used. As this would not be a good description of the architectural experience the terms »*emotional loading*» or »*emotion connection*» have been introduced.

An emotion can be directly connected to a perception, or there can be an intermediate link in the form of a meaning. Emotion connections are more or less stable and often have the character of latent possibilities which can be made manifest through several connections appearing simultaneously. The connection is not always to a single emotion, but very often to a complex of emotions called a *sentiment*. Emotions and sentiments build series from sensorial emotions to basic emotions. The emotion connections also have evaluations.

"Character", "emotion connection" and "emotional expression" have here been described as if they were three essentially differing entities. It might also be said, of course, that they are all some kinds of expression, in which case the word "expression" acquires another, much wider, definition than the one used here. With the concept of meaning that we have been using, however, it can only be said that the character of a perception is the last attenuated remainder of meaning or emotion left when an attempt is made to judge the "pure" perception.

To the three categories of mental entity hitherto evaluated we must now add some more.

First, there are the private, individual *associations* which are however of no interest to the architect, who must be more concerned with inter-subjective entities than with private connections between mental entities.

As was mentioned in the introduction, the aesthetic evaluations are not the only ones in the realm of architecture. There are also the *practical* and *social* evaluations which are of course of great importance, but I do not intend to discuss them here.

The different kinds of evaluation judgements are given concerning incommensurable categories of experience, and yet in everyday life a choice must every minute be made between them, that is unless something can be created which will be highly evaluated from every point of view; which is seldom the case. An *evaluation or gradation of the evaluations* is required.

The different aspects of evaluation that are valid for architectural experience may be a little difficult to keep in mind without a diagrammatic representation. Therefore I have made the drawing in Fig. 21: 1, depicting the main dimensions or aspects in the field of evaluation that are relevant to architectural theory. This is discussed in greater detail in my book *The Language of Architecture*.

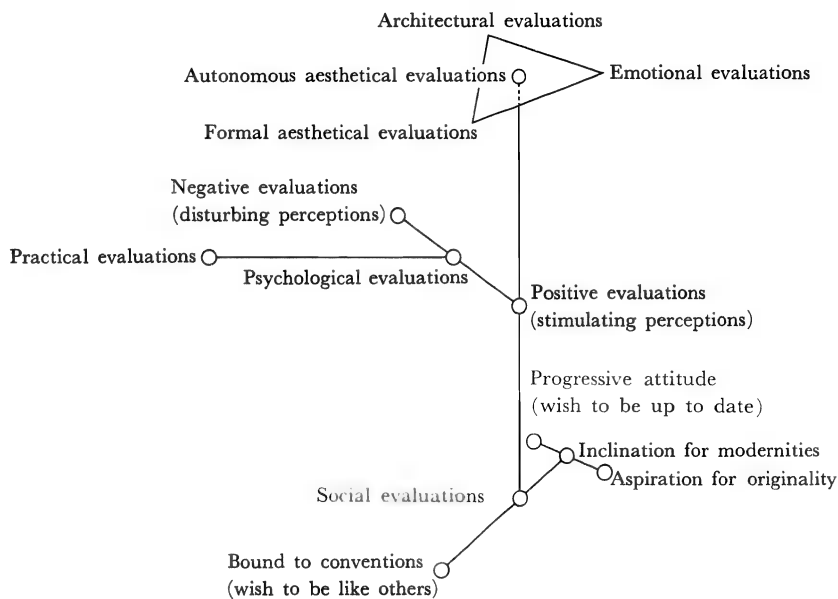


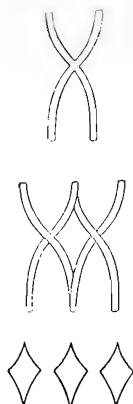
Fig. 21:1. Diagram of those evaluations relevant to architectural theory.

An example of an extraordinarily sensible and harmonious ensemble of formal aesthetic and semiotic values is given in the easy chair illustrated in Fig. 21: 2. Looking at the chair, one can see that those parts which are meant to be grasped with the hands are very plastically formed so that their appearance gives rise to haptic images, while the back of the chair on the other hand has only visual aesthetic values. On the back, one can study the manner in which a complicated figure-background relationship attracts special interest — something which in itself gives rise to a formal aesthetic evaluation. Gazing at the crosses, one after the other, it will be found that the experience of the »figure» suddenly changes, so that a plaited figure will be seen at the point on the crosses where the two parts of the plait are visually placed on



*Fig. 21:2. An easy chair.
Designer, Acking.*

two different planes. Gazing for a longer period will suddenly make the holes appear as figures against the wood as background. To clarify this matter, Fig. 21: 3 shows the different figures described here.



*Fig. 21:3. The figures in
the back of the chair.*

So much for the formal aesthetic values. The most interesting fact about the semiotic values of this chair is that the form expresses at every joint how the chair is put together. Where extremely strong joints *seem* necessary, the *expression* of the joint is stressed. Note for example how the arm-rests thicken where they meet the back, in a way which clearly expresses the strength of the joint. It should also be noted that the wooden framework of the seat never disappears completely but is always perceived as a »background» continuing behind the »figure» of the textile covering. Finally, the whole form of the chair gives a very good expression of the handicraft techniques used to assemble and sculpt homogeneous wooden parts.

In this description of the semiotic values of the chair, a certain value, the "style of the time", might be mentioned. Even though the chair is very expressive, it does not talk "the language of our time" — it does not give any expression to modern industrial techniques — simply because

such techniques were not in use when this chair was made. Is it then a negative value that the chair is made as a piece of handicraft, rather than with modern industrial tools? In answering such a question, the relativity of the aesthetic or architectural evaluation will be quite evident. To some, it will be of negative value — "the chair uses an antiquated form language" — to others it will be of high value — "the form describes well the tender care of a skilled craftsman".

22 Factors Influencing Behaviour and Evaluation

Let us sum up what we have dealt with so far, by means of a diagram like Fig. 22: 1. In this diagram S is the symbol for Stimulus, M=Mental procedure, R=Reaction or Response.

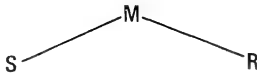


Fig. 22:1. The classic stimulus-respons arch.

A stimulus can always be observed by an observer, who can measure it by means of some physical instrument. If a stimulus is given to a person («subject») he will (perhaps) react, and the observer may be able to study this reaction. But the experience «inside» the subject, which occurs as a result of the stimulus touching a sense organ and which in turn gives rise to the reaction, cannot be studied by the observer. It can only be studied by the subject himself, who can tell the observer, in one way or another, about this mental experience that we have called the Perception Process. The content of this book is mainly devoted to a description of the M in our diagram. However, it might often be of some value to predict something about the behaviour of a person when he is put in a certain stimulus-situation. One then arranges laboratory experiments where S can be changed in a controlled way and where R can be recorded systematically. One of these experiments might be described as follows.

The subject is looking into a model of a room. In the middle of the room there is a table. Beside the table two easy chairs, in the opposite corner of the room a TV- screen. Above the table there is a light fitting which can be moved up or down by means of a wire, operated by the subject by means of a handle. The subject is asked to alter the height of the light fitting to the position he finds most suitable. Some differences in the opinions of this height occur, but taken as a whole all subjects gather around a mean, and the distribution of the preferred

heights shows a nice normal distribution curve (a Gauss curve). But by mistake, someone made a slight change in the furnishing of the room. The easy chairs were put closer together and at the same time the TV screen was turned so that it didn't »look« at the place where the chairs stood. Something astonishing happened: The distribution curve of the values for the preferred height remained as a Gauss curve but its mean shifted significantly from that in the first experiment. (This experiment was told to the author by Professor Thomas Markus, Strathclyde University, Glasgow).

At the first stimulus setting the subject perceived a room, inviting a certain attitude: sitting together in a drawing-room, looking at TV. The second room gave another invitation: sitting close together, not looking at TV but perhaps talking to each other. This change in the social situation changed the behaviour of the subjects. The change of behaviour may perhaps mirror a change in an unconscious evaluation.

V RESTRICTED SPACE AND TOWNSCAPE

23 Solid, Cavity and Space

To have a full understanding of architecture from the point of view of perception, it is necessary to study that complicated perception called architectonic space and room. If this perception is not present in a human creation, it is not usually referred to as architecture, but perhaps as sculpture, or furniture, handicraft or industrial design.

When beginning the study of perceived room and space, it will immediately be discovered that this perception is a very complex one in which several different perception modalities take part, but that in spite of this the perception itself appears as a unit or Gestalt, which can only be analysed later. During the analysis, it will be necessary not only to notice the different factors, but also to clarify the pattern into which these factors enter.

Figure and Background. — The phenomenon of figure and background described previously plays an important part in the perception of room and space. The examples

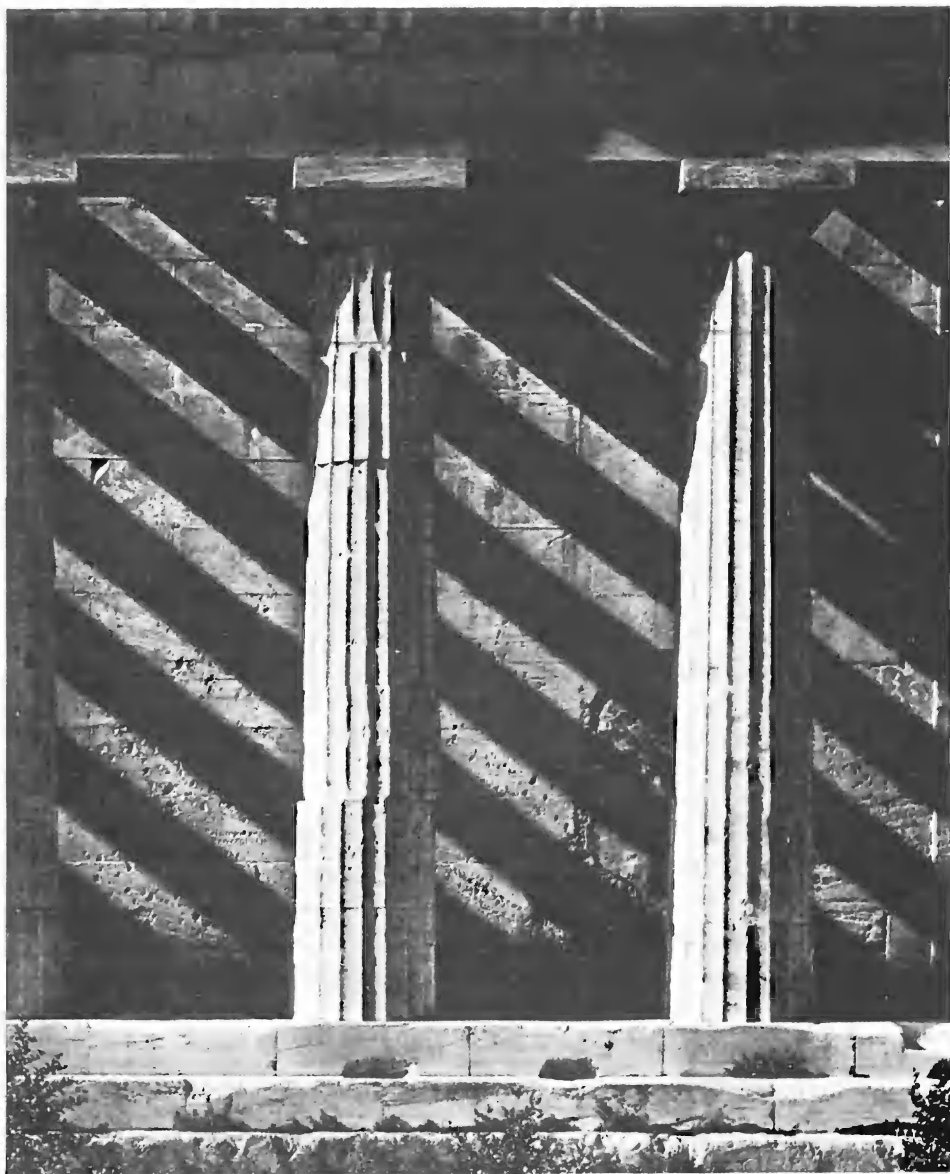
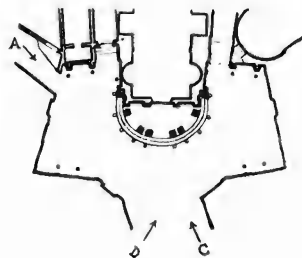


Fig. 23:1. Columns as figures against a wall-background.



Fig. 23:2. Santa Maria della Pace. (After Rasmussen.)



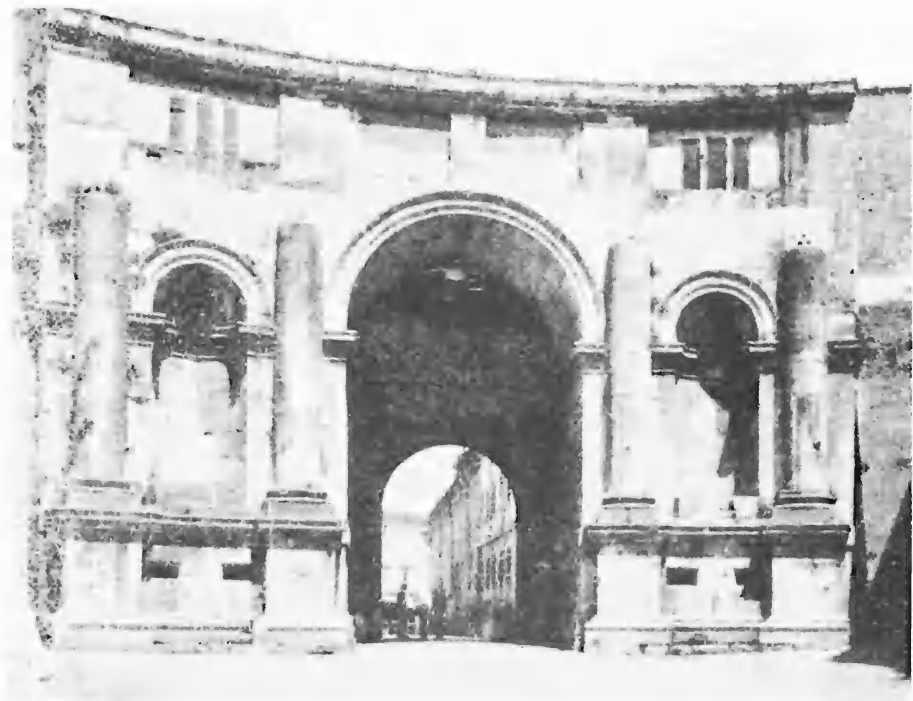


Fig. 23:3. Porta di Santo Spirito. (After Rasmussen.)

which follow from ancient western architecture will perhaps help to explain this.

The columns in Fig. 23:1 can be seen as figures against the background of the wall. The perception is not of a flat figure, like Rubin's experimental figure, but of a three-dimensional figure, which, like similar figures in everyday life, is called an *object*. What is perceived between the columns and the wall is an *empty space*.

In the Greek temple, this space was not handled very consciously by the architect, but a later example shown in Fig. 23:2, the Santa Maria della Pace in Rome, shows immediately that the space within the portico is perceived as a definitely defined space, created consciously by the architect.

The Porta di Santo Spirito in Rome, Fig. 23: 3, gives a further example of the difference between object and space. The building itself has the character of an object;

but its gateway is perceived as a space which can be entered. On examination, however, the exterior walls are found to have some convex and some concave parts. The *convex* parts are experienced as half-columns attached to the wall; they have the character of objects, solid material. The *concave* parts, the niches, are perceived as places where something has been taken out of the wall leaving empty spaces or cavities. This contrast between solid and cavity has been used for a conscious artistic purpose.

However, we shall now concentrate on the perception of restricted space. We may start by looking at Fig. 23: 4, Rubin's classical figure-and-background illustration. We notice that when a white vase is perceived as the figure the black background continues apparently undestroyed behind the vase; and when two black faces are perceived the white background continues undestroyed behind the faces.

Let us now take a look at Fig. 23: 5, the cover of a leaflet about hotels. At first we read the letters H-O-T-E-L-S in light colours against a black background, and the black background continues undestroyed behind the letters. But then, suddenly, we detect fragments of a facade of a building within the letters and in the same moment figure-and-background shifts. We now perceive a black sheet, with some holes in it, as figure and through these holes we see the facade of Brussels town hall as an unbroken background behind the black figure, and we cannot see the letters and can no longer read the word HOTELS. But, even more interesting: we perceive a distance between

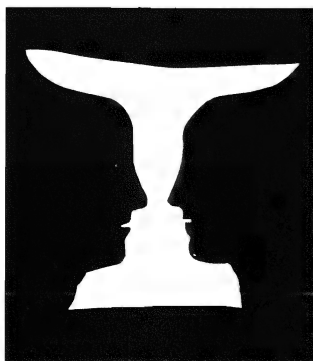


Fig. 23:4. Rubin's classical figure-and-background demonstration.



Fig. 23:5. The cover of a hotel leaflet.

the figure and the background. However uncertain the space between figure and background is perceived to be, one thing is certain: we do perceive a restricted space. And it is this architectonic restricted space that we have tried to study experimentally in a series of experiments carried out in Sigtuna (a small town in Sweden). The experiments were carried out by the author in collaboration with psychologists from the Royal University in Stockholm.

The first question that we have tried to tackle was: can a subject estimate the intensity of the perception of restricted space, and can he compare two different spaces in this respect? Can he quantify that perception in any way?

The next problem to be investigated is the following:

The perception of restricted space is built up of several more elementary entities. It has been confirmed during field studies by a lot of architects that this is the case. Can it also be verified experimentally?

In Sigtuna we had the possibility of using the so-called studio church while it was empty. The shape and measurements of this building are shown in Fig. 23: 6. We placed some screens in this building in order to create a »room within the room». The number of the screens was varied as can be seen in Figs. 23: 7–9.

Above this »room in the room» we hung a searchlight which sent a beam of radiant energy exactly within the boundaries of the »room in the room». The radiation was variable and we could choose to send either 1 lux, 10 lux, 100 lux or 1 000 lux into the room (measured at floor level). These figures gave us approximately equal steps in the perceived (apparent) brightness. In this way we were able to create $4 \times 4 = 16$ different stimulus situations for our subjects who were placed outside this »room in the room», looking into it. They were asked to estimate the intensity with which they perceived a restricted space in the »room in the room».

Without going into details here concerning the statistical analysis of our data, I will just report our findings in form of a diagram, Fig. 23:10. This shows that the intensity of the perception of restricted space varied with the number of screens and also with the amount of radiation from the searchlight, and that the contribution from the light perception can well be compared with the contribution from the visual form perception aroused by the screens.

From this experiment we think we have learned that our experimental method works: we *can* measure the intensity of the perception of restricted space, and we *can* measure contributions from different perception (or sensation) modalities. But we can not yet draw any practical conclusions as to how to handle visual form and light perceptions. For this purpose more complicated experiments will have to be carried out.

24 Internal and External Room

It is not necessary to be inside a building in order to have the experience of room as restricted space. For example, if one is standing within an area marked by upright

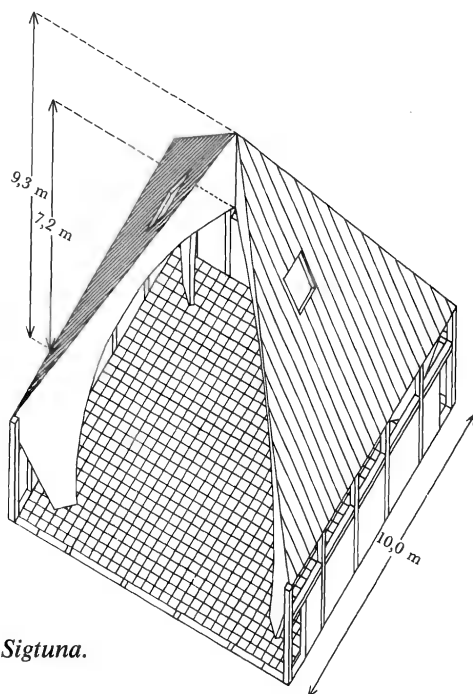


Fig. 23:6. The studio church in Sigtuna.

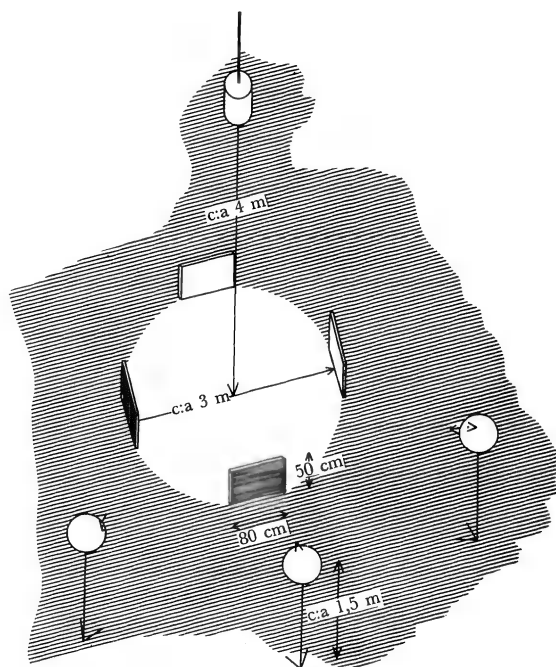


Fig. 23:7. A restricted space, created of four screens . . .

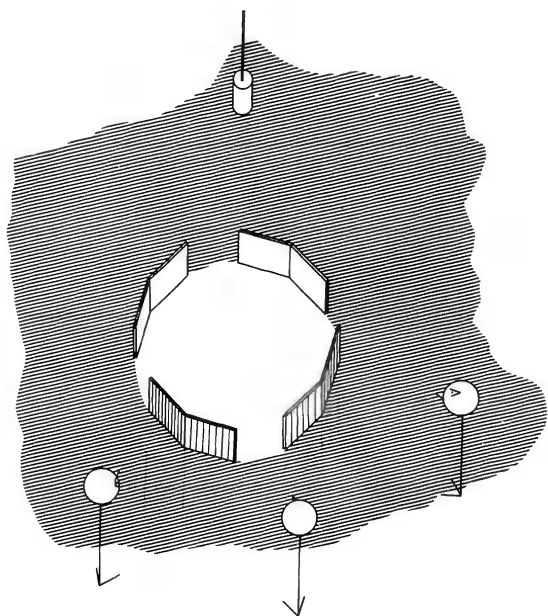


Fig. 23:8. . . . of eight screens . . .

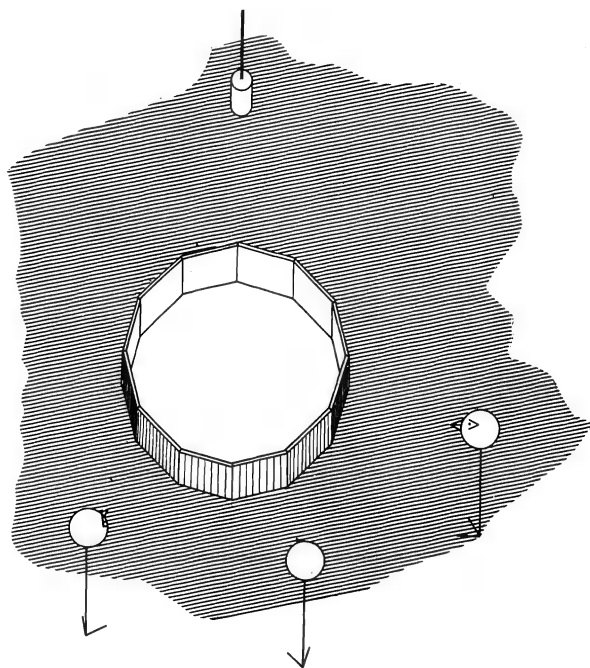


Fig. 23:9. . . . and of twelve screens.

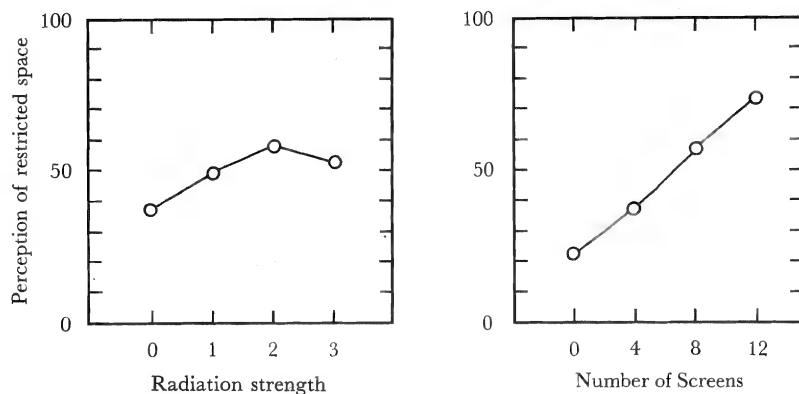


Fig. 23:10. The intensity of perceived room varies with light radiation as well as with number of screens.

stones, such as at Stonehenge, there will be a vague feeling of being in a restricted space, a room. The larger and the closer together the stones are, the stronger this impression will be. An even stronger impression can be created by the use of latticework or paper walls, as in a Japanese house. If the walls are so arranged that they are perceived not as screens but as a unit, the experience of a room will be quite definite.

From this it should be clear that it is possible to speak of exterior and interior room. In fact the space outside a building is often experienced as restricted or enclosed, especially where other buildings, trees, or other features act as walls. The history of architecture contains many examples of consciously arranged exterior and interior rooms. Fig. 24: 1 is a reproduction of a plan of central Rome, made by Nollis in 1748. On this plan one can study the rhythmical play between consciously created internal and external rooms. The area marked 598 on the plan is shown on a greater scale in Fig. 23: 2, together with a photograph of the exterior of the church of Santa Maria della Pace. I have already pointed out how the portico has been inserted as an object into the restricted space of the square, and how the portico itself embraces another restricted space, which is the overture to the church itself.

The Unity of Interior and Exterior. — In Santa Maria della Pace, the interior, half-interior and exterior spaces

are not merely connected, they communicate with each other and build a unit of a higher order. Furthermore, the rooms also communicate with the objects — the pillars and other details; when perceiving the pillars as figures, the rooms or spaces are perceived as backgrounds but the experience can suddenly change so that the rooms — the enclosed spaces — are perceived as figures and the walls, and other enclosing elements as the background.

The exterior of a building has, to a certain extent, the same character as a sculpture. It is often possible to walk around it and perceive its different aspects successively. This sculptural character can continually change into architectonic room, through porticos or in other ways. The exterior and interior are not two incomparable

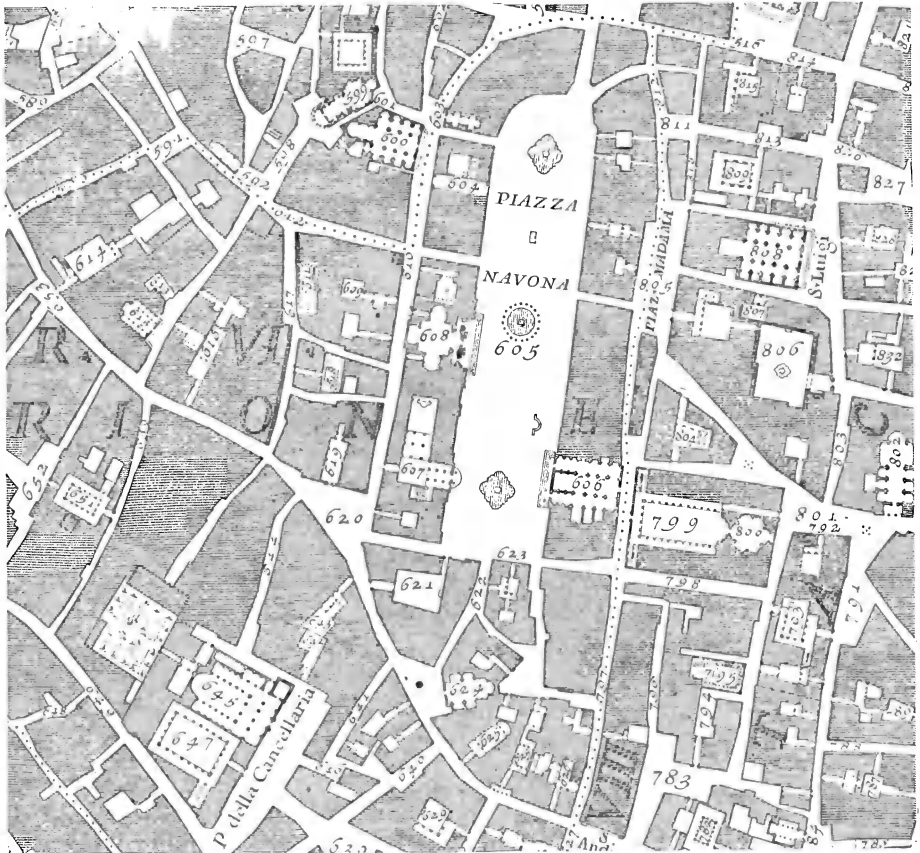


Fig. 24:1. Nolli's map of central Rome.

antitheses, but can better be regarded as the two extremes in a polar series. Intermediate forms, where the exterior floats imperceptibly over into an interior, can be found everywhere in the history of architecture, from the colonnaded Greek temples to modern buildings. The emotional value that can be hidden in stressing the differences between out and in, in the »conversation« between sculptural object which must be walked round, and in room which itself surrounds one should not be forgotten. Rasmussen has drawn attention to the fact that it is most usual that an architect works *either* with room *or* with exterior. The ideal, of course, would be to create a building where the dialogue between outside and inside is perfect, and where the exterior introduces the interior.

25 Townscape

One of the most important differences between man and beast has been man's ability, from the time he entered history, to create his own environment. He has made clothes for a more comfortable personal micro-climate, and he has lived, together with his family, in dwellings of some sort, from natural caves to simple if crude houses, which have afforded both protection and a better psycho-climate. In creating these conditions for a better life, he has not only behaved as an individual but also exhibited a tendency to live in groups or societies, and he has created the physical conditions for these societies too.

A review of the development of this trend towards a more or less artificial environment would perhaps start with the ancient caves south of the Sahara and proceed, via an ancient »trullo« village in Italy, to ancient Pompeii, which was buried under eight meters of ash when Vesuvius erupted in the year 79; and end with the plan of Rome discussed earlier (Fig. 24: 1).

One striking fact emerges from these examples and their development, and that is that the experience of room has from the very beginning been an essential part of man-made environment, and the interplay between external and internal room has become more and more refined and exquisite. The Rome of 1748 might perhaps be regarded as the culmination of this architectonic enterprise.

The twentieth century reveals a rather confusing development, which may be seen in Ethiopia in the two towns of Asmara and Addis Abeba. Both were founded towards the end of the previous century; but while Asmara was built according to old western traditions, Addis Abeba was more or less inert from the point of view of planning until the end of the second world war. Meanwhile, one essential change has occurred since the days of the Rome of 1748. The old ideas of architecture inherited from that time have given way to new ideas of "air and light" expressed in the slogan "buildings in green belts". According to these new ideas, buildings ought not to be connected but separated. This way of creating a town will certainly give free space with enough air and light, but the architectonic room will disappear and there will no longer be any interplay between interior and exterior room. Thousands of towns all over the world have been built, rebuilt or extended according to these new ideas, but now it is possible to detect what has been lost: the town, from the perceptual point of view, has now been re-discovered and this has made us more aware of what we have missed.

A great need for the extension of older towns and the planning and building new ones was felt all over the world after the second world war. The most serious efforts made in this direction were perhaps in Great Britain, a result of the over-crowding in London. A series of new towns was built in order to save London and various other older towns.

Of course the planners planned these new towns in accordance with the most modern and progressive ideas; but strangely enough, most people did not feel happy in them. When architects began to investigate why this was, they very often found the reasons hidden in the perception of the town, and a new concept was coined — "townscape" — which in fact implies *applied perception psychology*.

Solid and Space. — As has been previously described in reference to Santa Maria della Pace, the interplay of solid and space plays a key role in the perception of townscape. It might be mentioned here that several good



Fig. 25:1. The piazza and piazzetta in Venice. Photo by Rotkin.



examples of townscape at its best can be found in some of the older Italian cities where sensible architects have been working for centuries in gradually developing their knowledge and putting it into practice. Florence and Venice might be mentioned among the most well-known examples. Fig. 25: 1 — the tail-piece to this chapter — shows the famous Piazza of Venice, which gives the architect of today something to reflect upon: why are we unable to create such grand townscape today? We certainly have the economic and technical means.

26 Literature on Townscape

28th June 1965 — The periodical "Bauwelt" came out with an issue on the building of towns, *Bauwelt* 26/27, *Stadtbauwelt* 6. This issue was devoted in particular to the question of the reconstruction of Stuttgart. It began with an article called ". . . jetzt, in dieser Übergangsperiode . . ." ("Now, during this transitory stage . . .") written by Theodor Goecke and Camillo Sitte *in the year of grace 1904*. This implies a revival for ways of thinking and looking at things that had aroused great interest when first presented but had soon been forgotten.

1889 — At the end of the nineteenth century there had been an increasing interest in the «beauty» of the older European towns, especially those of Italy, southern Germany and southern France. Sitte's book «Der Städte-Bau nach seinen künstlerischen Grundsätzen» had appeared in 1889 and had immediately been received with great interest; the second edition appeared in the same year and the third in 1900. Sitte died in 1903, and posthumous editions appeared in 1908 and 1921, but then silence fell around Sitte's ideas and they were forgotten for nearly half a century.

What was it that was so remarkable about Sitte's ideas — why were they forgotten and why were they rediscovered? Sitte had fallen in love with towns, the towns of brick and stone, the real towns; but not just any stone town. His love was for the medieval towns of Europe, in the form they had acquired during their growth — which was often very gradual — as centres of commerce and culture. He wished to show how people had turned the necessity of living close together into something positive.

The possibilities of stimulation that the town — in contrast to the country — could offer were exploited to the full. Sitte determined to investigate just how this had occurred: he analysed all the old, picturesque towns and was particularly interested in their squares which he investigated during his journeys. He studied the measurements of the squares that had been most admired, taking specific interest in the relation between the plan dimensions of the squares and the height of the surrounding buildings. He presented his studies both in plans and in words; an example is given in Fig. 26: 1. He began, as one should, with Pompeii, the Forum Romanum, Olympia and the Acropolis in Athens. Naturally, the Square of St Peter and the Piazza in Venice are included among his descriptions, but even so it was the apparently unplanned, naturally-grown medieval towns that he really loved, with their crooked streets and irregular squares, and the surprising experiences waiting round the corner. It was in fact the stimulating experiences in towns that interested him.

But there soon came a new movement in the history of architecture; the one known to us as »functionalism«. The starting-point for this was that the dwellings being built after the first world war did not meet the needs of anyone but a member of the »upper ten«. It was urged that the design of dwellings must be based on a thorough study of the material and practical needs of an ordinary human being; and it was considered that this was the

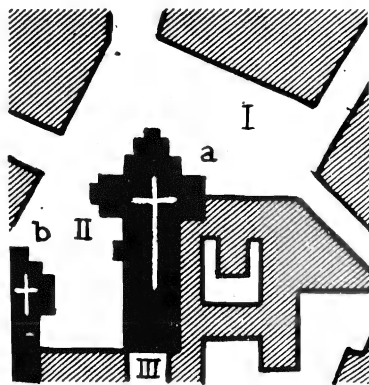


Fig. 26:1. Plan of central Würzburg. (After Sitte.)

necessary and at the same time the only precondition required for architectural design. One was not permitted to discuss aesthetic problems; aesthetics were a dirty trick, »opium for the people«. The rational functionalism regarded Sitte's studies as antiquated romanticism and they were forgotten. His book was in fact translated into English in 1945 under the title »The Art of Building Cities» but it was not until 1965 that the real change began; a new German edition was published, and a new English translation, »City Planning according to Artistic Principles«. And during the sixties a whole series of books about townscape began to appear, especially in Great Britain, the USA, and Germany.

The reason for this new interest was of course the poor success of the new towns, planned and built after the second world war, that we have already mentioned. At the same time Perception Psychology was developing and more and more people were beginning to understand the importance of studying architecture and townscape from a perceptual aspect. I might be permitted to mention here that my doctorate thesis »Arkitekturens Uttrycksmedel» («The Means of Architectural Expression») was published in 1954. A Spanish edition was published in Buenos Aires in 1964; and my book »The Language of Architecture», 1967-70, may be regarded as a revised edition of this thesis. Here I want to give a rough survey of the literature, and in particular the new literature, on the subject; but I wish to point out that it really will be very short. A more detailed study would provide material for a complete dissertation. I limit my survey to published books; articles in periodicals are left to their fates. And I do not pretend to know about all the books either; but I hope that the most important ones have been included. I take them in chronological order, starting with Sitte, the pioneer.

1889 — Sitte, C., »Der städte-Bau nach seinem künstlerischen Grundsätzen» (latest German edition 1965, latest English translation »City Planning According to Artistic Principles», 1965). Sitte's work is described in the above introduction to this literature survey.

1912 — A.E. Brinckmann's »Platz und Monument» (foreword dated 1908) was influenced by Sitte, but Brinckmann

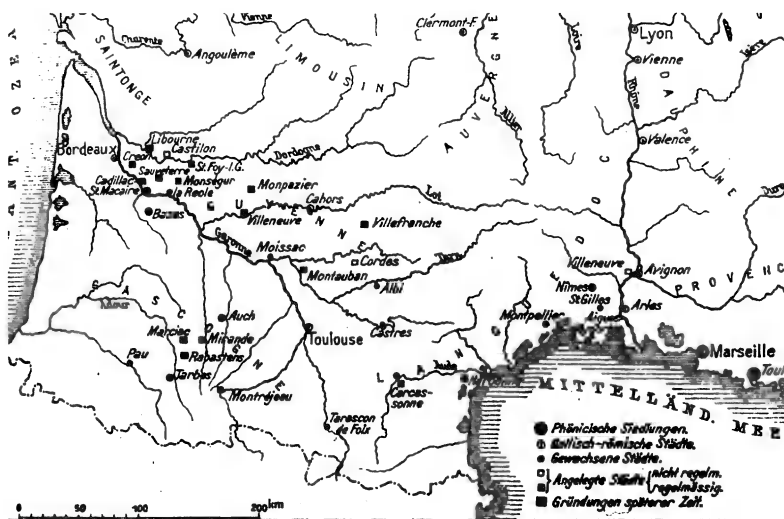


Fig. 26:2. Naturally grown and planned old towns in the south of France.
(After Brinckmann.)

was more interested in the centuries 1500—1800 when the strictly-planned cities were being built in Europe. Brinckmann was a prolific writer and, according to my information, has written eight other books:

Spätmittelalterliche Stadtanlagen in Süd-Frankreich (1910)

Deutsche Stadtbaukunst in der Vergangenheit (1911)

Die Baukunst des 17. und 18. Jahrhunderts in den Römischen Ländern (1915)

Stadtbaukunst (1920)

Plastik und Raum (1924)

Theatrum novum Pedemontii (1931)

Baukunst (1956)

Die Künstlerischen Werte im Werk des Architekten (1956).

Brinckmann too was soon forgotten. It is perhaps symptomatic that I could not find any of Brinckmann's books in either of the two libraries of architecture at Stockholm's Royal Institute of Technology.

1922 — Strengell, G., »Staden som Konstverk« (»The Town as a Work of Art«). Strengell's interesting preface states »it is a deeply regrettable fact that there is no



*Fig. 26:3. Plan of
Sauveterre-de-Guyenne.
(After Brinckmann.)*

longer any real or significant art of townbuilding in existence.» He explains that he has written his book, under the influence of Sitte and Brinckmann, in order to make their work better known in Sweden and the Swedish-speaking provinces of Finland; one may assume that his book was also intended to correct the one-sidedness present in both their works, Sitte's concentration on the

*Fig. 26:4. Market place
in Sauveterre-de-Guyenne.
(After Brinckmann.)*



irregular medieval town and Brinckmann's interest in the geometrically planned cities; his book contains both well-known show-pieces and relatively unknown townscapes, illustrated with plans and photographs.

When Strengell had published his book he could see a growing interest in these positive factors in man's experience of town environment but simultaneously, there arose two schools of thought that were founded on the negative aspect apparent in city living.

1898 — This was the date of *Ebenezer Howard's* book »*Tomorrow, a Peaceful Path to Real Reform*» in which he pleaded for the garden city. The basis for his work was of course the social misery that was apparent in England's expanding cities, but even questions of the perception of the environment were considered important, as witnessed by the two garden cities that Howard inspired, Letchworth founded in 1903—04 to the plans of Raymond Unwin, and Welwyn Garden City, which the visitor from our times can now experience, perhaps a little nostalgically, as a sometimes unbelievably beautiful man-made environment.

1920 — *Unwin's* book »*Town Planning in Practice*» was published in this year and again in 1932. For a long period large groups of architects and town planners were, like Howard, only aware of the negative aspects of the conventional city of brick and stone.

1923 — New ideas in architecture were also coming from France; ideas which denied any justification to most of the architecture in existence, including the conventional city as such. *Le Corbusier's* »*Vers une Architecture*» was published in this year, and followed in 1925 by »*Urbanisme*» in which he presented his Plan Voisin for Paris, which had been exhibited there in 1922. It is fairly clear to anyone who studies the plans and drawings illustrating the Plan Voisin that le Corbusier did not concern himself at all with the experience of town environment from the point of view of outdoor restricted space. He seems mainly to have regarded the restricted space of streets and squares as an abomination; his motto was »house in park». In the German translation »*Grundfragen des Städ-*

tebaues» (translation 1945 of »*Propos d'Urbanisme*») the first twenty-six pages are devoted to a quick sketch of Western cities, in drawings and in words, but there is nowhere any understanding of the *experience of restricted space* in the Piazza in Venice or in the comparable places in Paris, Rome or elsewhere. On the contrary, he consistently refuses all planning which might give rise to such experiences and obstinately returns on p. 107 to »*der Stadt im Grünen*» as the only salvation.

Architects all over the world listened to le Corbusier's words, the older ones shocked and on the defensive, and we younger ones with enthusiasm; and thus it was that the experience of town environment and the restricted space of streets and squares disappeared from all discussion.

1934 — Literature about the positive aspects of towns of brick and stone appeared only sporadically, but there is one name that shines like a star in the night sky, *Steen Eiler Rasmussen*. In 1934 the first edition of his book »*London*» was published, which is, even according to English experts, the best book about that city ever written.

1949 — *Rasmussen's* »*Byer och Bygninger*» (»*Towns and Buildings*») was published, containing a chapter called »*En fortaelling om to Byer*» (»*A tale of two cities*»), which was a comparative study of London and Paris, explaining the difference in character that has emerged from the different political situations in the two capitals. The French approach to town planning used by Haussmann, with monumental axes and grand vistas, could only be practiced in a country with an absolute monarch such as Napoleon III. The political tradition in great Britain was very different; London was created and governed by merchants and craftsmen as a body and did not allow incisions such as the boulevards of Paris. Instead, the English developed a taste for privacy and intimacy in townscape, which is among other things reflected in the squares of London.

Rasmussen has given further examples of his skill as a writer and analyst of the experience of town environment in »*Om at opleve Arkitektur*» (*Experiencing Architecture*).

ture) in 1957 and "*Köpenhamn*" (*Copenhagen*) in 1969; I will not mention the rest of his literary achievement here. But Rasmussen was for a long time the alone swallow that does not make a summer.

1937 — *Constantinos Doxiadis* published his much-debated *»Raumordnung im griechischen Städtebau«*. He returns later with his ekistic program, town plans in the USA, Pakistan and Iraq, concrete shell church in Ethiopia, town planning institute in Athens, and his books of the sixties. But these are not about the experience of town environment.

1938 — *Lewis Mumford's* *»The Culture of Cities«* was published in 1938 and was followed by other books. His illustrations say quite a lot about the experience of town environment; but his text does not. It is not until *»The City in History«* is published in 1961 that he really takes these problems up to serious study; but when he does it is with a wide range of material, from the pyramids in Egypt to the as yet unrealised suggestion for the construction of a new Precinct to St Paul's, in London, to replace the one almost completely destroyed in the Blitz.

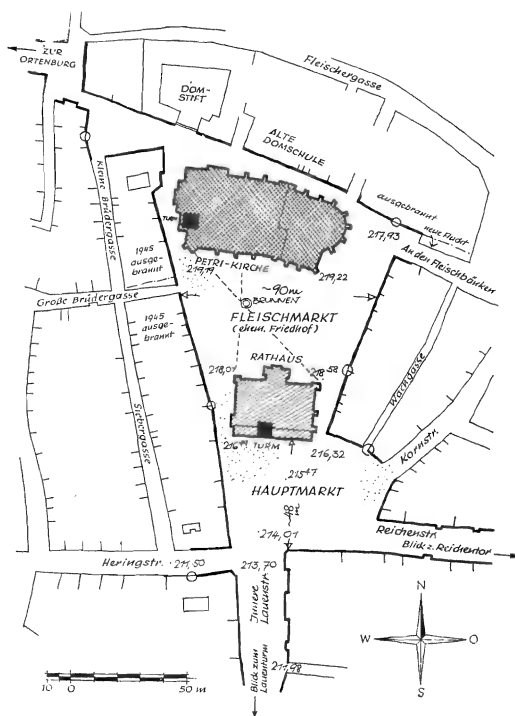
1941 — *Siegfried Giedion* publishes *»Space, Time and Architecture«*, which was based on his lectures at Harvard since 1938. In part VII of the book he does deal with subjects like the squares of London and the boulevards of Paris, but without any attempt at perception analysis.

1943 — *Eliel Saarinen's* book *»The City, Its Growth, Its Decay, Its Future«* is published. Under the title *»Haussmann versus Sitte«* he demonstrates that he does know about Sitte, but he does not really say anything more than what Sitte himself had said and done. He criticizes Sitte's love for irregular towns and advocates *»architectural order«*.

1956 — The destructive force of the second world war has passed across Europe; many of the old medieval towns in Germany have been demolished, and an interest arises for what is left. *Wolfgang Rauda* has taken on the task of describing these old treasures by means of measurements, perspective drawings and so on; his book

»Raumprobleme im europäischen Städtebau« is published in 1956. The first Chapter is concerned with »space and its perception«; he continues with detailed descriptions of squares and open places and the experiences of restricted space that they give. He takes a wide sweep through space and time, from Florence and Rome to Oslo, Gothenburg and Copenhagen. His next book was published just one year later in 1957 and is called *»Lebendige städtebauliche Raumordnung«*. It is entirely devoted to a number of the German medieval towns; he describes them thoroughly, expertly and lovingly, with town plans and detail plans, elevations of the space-defining buildings, perspective drawings, hypothetical "space bubble envelopes" (I borrow this term from Arne Branzell, who has coined it in an as yet unpublished (1970) PhD thesis), and other descriptions of his own experiences in perceiving these townscapes, in words and drawings. He

Fig. 26:5. Plan of central part of Bautzen. (After Rauda.)



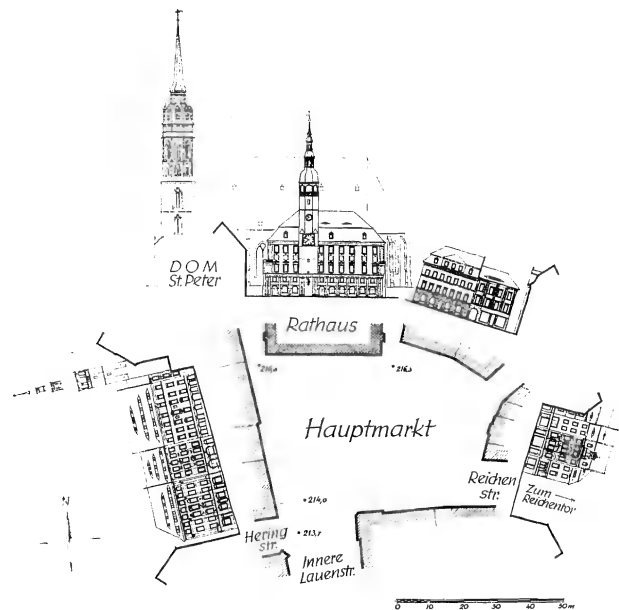


Fig. 26:6. Plan of "Hauptmarkt" in Bautzen. (After Rauda:)

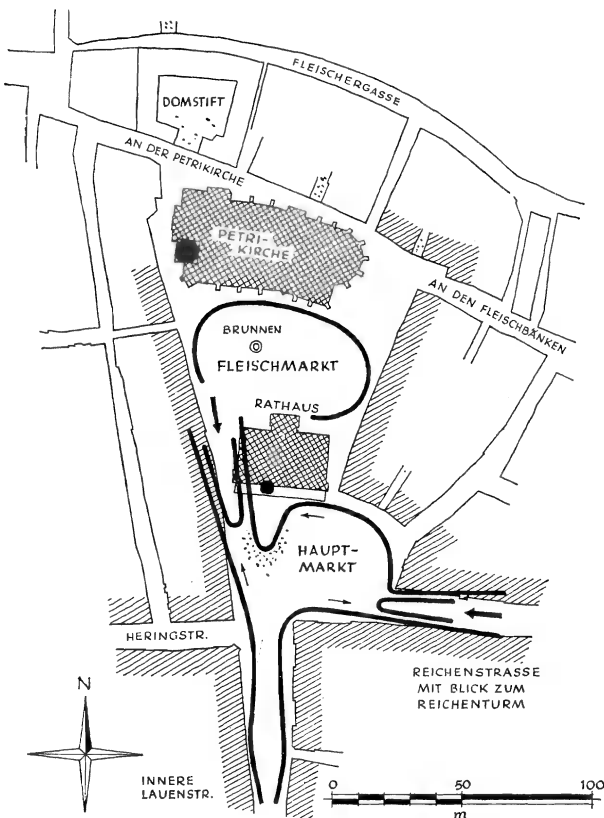


Fig. 26:7. An attempt to illustrate the perception of restricted space in the centre of Bautzen. (After Rauda.)

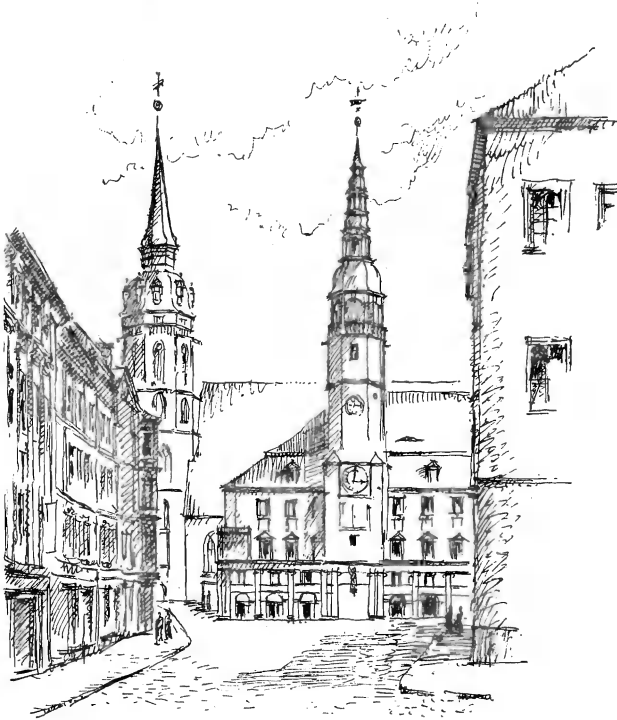


Fig. 26:8. Perspective drawing through "hereness" to "thereness". (After Rauda.)

also shows how their charm could easily be destroyed by unwise "adjustments". Rauda had studied both Sitte and Brinckmann and develops their ideas in his book.

1959 — In 1953 Paul Zucker was awarded the Brunner Scholarship Award for his manuscript *"Town and Square"*, which was then published in 1959. As is implied by the sub-title, *"From the Agora to the Village Green"*, Zucker's work stretches further in space and time than that of any of his predecessors; for he has dealt with the empty space in towns historically, beginning with Ancient Greece and ending with the early public squares in the USA. Nor is his interest restricted to Western examples: Fig. 26:9 shows the site plan of the famous mosque Maidan-i-Shah in Isfahan. He has not even restricted himself to towns that have been built: Fig. 26:10 shows Dürer's project for an Ideal City. In his book Zucker gives what is presumably the longest bibliography on the subject (yet it still lacks some of the literature mentioned in this summary, in particular those titles published after 1959). Of

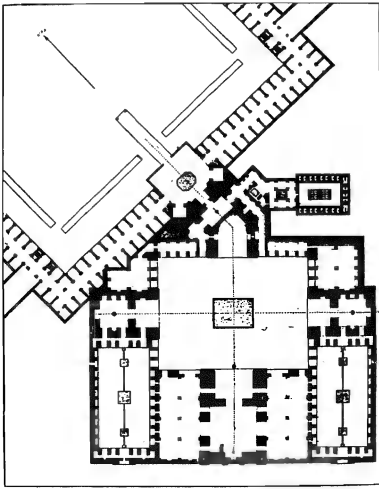
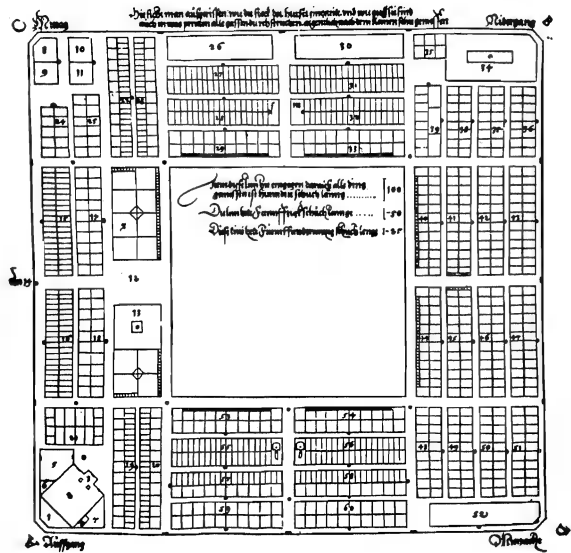


Fig. 26:9. Plan of Maidan-i-Shah, Isfahan. (After Zucker.)

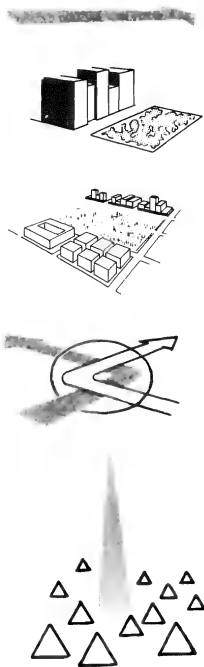


*Fig. 26:10. Dürer's projekt for an ideal city.
(After Zucker.)*

course his book is extremely well worth reading, but perhaps it gives little that in essence goes beyond his predecessors.

1960 — saw the publishing of a book which became the subject of much discussion: *Kevin Lynch's "The Image of the City"*, followed a couple of years later by "*Site Planning*" (1962) and "*The View from the Road*" (1964), this latter in cooperation with two other authors. Lynch's approach was new; like his forerunners, he had studied the admired old Italian towns, as well as the younger towns in the USA, but he became interested in the conceptions (images) that follow after the perceptions. In studying this image of the city that we carry within us as a reminiscence of the experiences we have had, Lynch thought that he was able to demonstrate certain structuring features, within the mainly subconscious total image, that were important for orientation. He lists these factors schematically as in Fig. 26:11. Much research has been done succeeding Lynch's.

Fig. 26:11. Path, edge, district, node, landmark.
(After Lynch.)



1962 — Gordon Cullen's book *«Townscape»* appears; it is a summary of his articles through the years in the British periodical *«Architectural Review»*. The term *«townscape»* was coined by Cullen, as a parallel to *«landscape»*. The illustrations and texts in his book give a large — I am tempted to say incredibly large — collection of details which he finds significant in the *«building up»* of the total experience of a townscape. His presentation has been criticized as unsystematic — though it may be just that reality is such that these details or factors as we might call them cannot be systematized. I will therefore take up just some of them to illustrate Cullen's way of thinking.

Fig. 26:12 shows a perspective drawing of a street; a car can be seen disappearing around a corner. Cullen calls the restricted space thus achieved a *«Closure»*. Such a Closure invites motion. Fig. 26:13 shows a square (in London?) where people have crowded, apparently because of the character of the restricted space, called by Cullen an *«Enclosure»*. A Closure ought always to end in an Enclosure, according to Cullen.



Fig. 26:12. Closure.
(After Cullen.)



Fig. 26:13. *Enclosure.*
(After Cullen.)

When moving along a crooked street like that in Fig. 26:14, one experiences at least seven different "townscapes"; and this counteracts monotony.

Cullen has since been employed in the analysis of some older British towns, that have been regarded as worth saving from the destruction that modern traffic technique, amongst other things, can cause. He has thus cooperated in the publication of *«Tenterden Explored»* (1967) and *«Llantrisant, a Welsh Hill Town»* (1968). His way of looking at things and his perspective sketches have formed the basis of a whole movement: subsequent presentations are sometimes indistinguishably like his own.

1963 — de Wolfe, I., *«The Italian Townscape»*. From de Wolfe's studies I want to take a description of the little town of Sabbioneta. Fig. 26:15. Nearly all of the views out from the town into the surrounding landscape are blocked, as may be seen; only one view is free, namely from the main square where the feudal baron once had his palace. The blocked views are marked specially on this map by de Wolfe. According to him they were consciously planned, in order to give the inhabitants a feeling of protection.

1963— saw the beginning of an avalanche of books about townscape, initially in Great Britain. It is impossible to

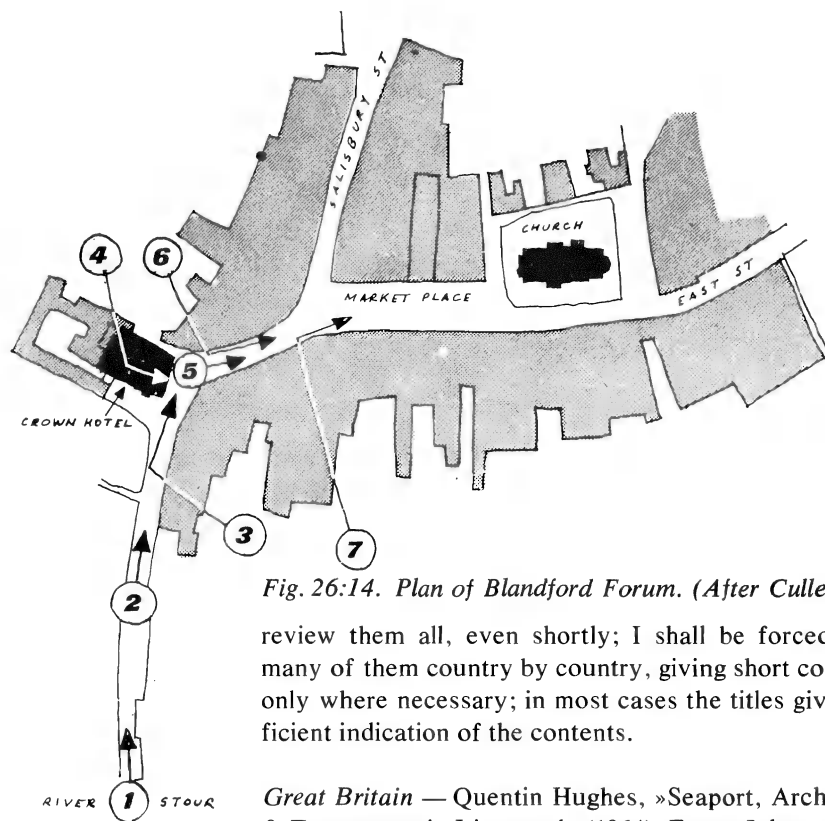


Fig. 26:14. Plan of Blandford Forum. (After Cullen.)

review them all, even shortly; I shall be forced to list many of them country by country, giving short comments only where necessary; in most cases the titles give a sufficient indication of the contents.

Great Britain — Quentin Hughes, »Seaport, Architecture & Townscape in Liverpool» (1964); Ewart Johns, »British Townscape» (1965); Percy Johnson-Marshall, »Rebuilding Cities» (1966), is about the rebuilding of towns which were destroyed by the war, and townscape-perception problems are hinted at; Thomas Sharp, »Town and Townscape» (1968); Pamela Ward, »Conservation and Development in Historic Towns and Cities» (1968); Frederic Osborn & Arnold Whittick, »The New Towns» (1969), containing a good survey of the 23 new towns in Great Britain, from Welwyn Garden City and Letchworth to Cumbernauld and Cwmbran.

United States — E. A. Gutkind publishes three extensive volumes: »Urban Development in Central Europe» (1964), »in the Alpine and Scandinavian Countries» (1965), »in Southern Europe: Spain and Portugal» (1967); Paul Spreiregen, »Urban Design: The Architecture of Towns and Cities» (1965); Julian Eugene Kulski, »Land of Urban Promise» (1967); Edmund Bacon, »Design of

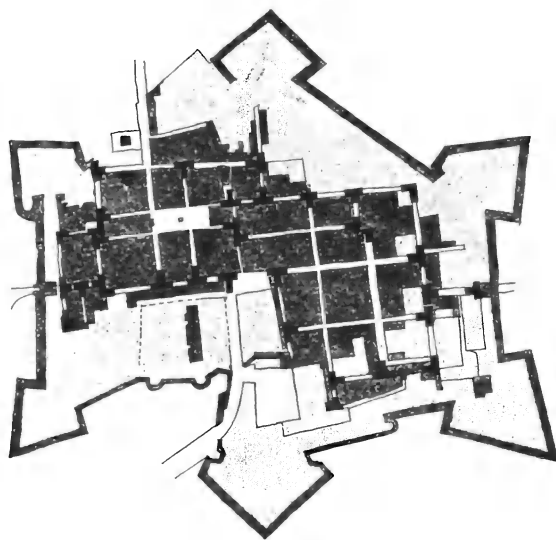
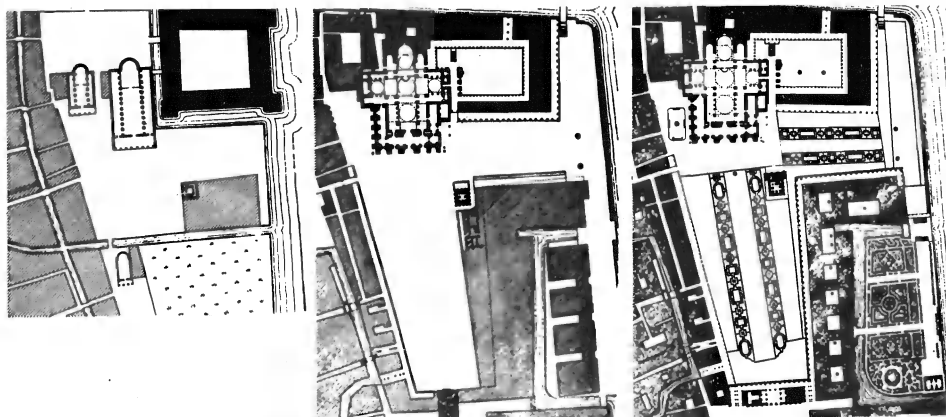


Fig. 26:15. Plan of Sabbioneta. (After de Wolfe.)

Cities» (1967), an outstandingly beautiful book realised with the aid of the Ford and Rockefeller Foundations, containing the most beautiful town plan drawings, often in colours. Bacon had visited the most famous towns all over the world and was especially interested in finding how these marvellous places had, during their history, been rearranged many times. As an instructive example, Fig. 26:16 shows the historical development of the piazza and piazzetta in Venice. It seems as if the old masters may have "sketched in full scale" for centuries, something that we are not able to do nowadays. We have to plan at once — and very quickly — towns that will never be changed according to aesthetic principles, but must have been sufficiently planned from the very beginning. This is the reason why we must study the old masters, and apply what they teach us.

Germany — Karl Krämer, »Einfamilienhäuser in der Gruppe» (1966) like Hubert Hoffman, »Neue urbane Wohnformen» (1966) and »Urbaner Flachbau» (1967) deals with what is neither city nor garden-town: communities like Halen and the modern Danish formations of chain- and terrace-houses; Sweden too is represented. However interesting and important this literature may be — and there are signs that this will in the future be the



*Fig. 26:16. The historical development of the piazza and piazzetta in Venice.
(After Bacon.)*

environment that we live in — I will refrain from any attempt at giving a literature survey until a later date: I wish to dedicate this survey to the experience of cities. Within this range are Lässig, Linke, Rietdorf and Wessel with »Strassen und Plätze» (1968); four architecture students have measured up the streets and squares of a number of well-known old and new cities which have been regarded as exemplary. They have made thorough surveys, presented in drawings with plans and elevations, and supplemented with perspective drawings, and the measurements are indicated as in Fig. 26:17; but the book only reports and does not analyse in the way that Sitte, Brinckmann or Bacon have done.

South America — Jorge Gazaneo & Mabel Scarone, »Lucie Costa» (1955); the authors give an account of how Costa, under the influence of le Corbusier, prepares his schema on Brasilia, wins the design contest and builds the city; Willy Stäubli, »Brasilia» (1965), a Swiss non-architect gives a thorough description of the new capital of Brazil, which stood complete in its main features after three or four years of construction. (Though it is not yet quite completed according to his plans.)

Asia — Norma Evenson, »Chandigarh», (1966), a survey of the new capital in Punjab, le Corbusier's own creation. But it is not only new things in Asia which attract interest; in 1964 the Agency for International Develop-

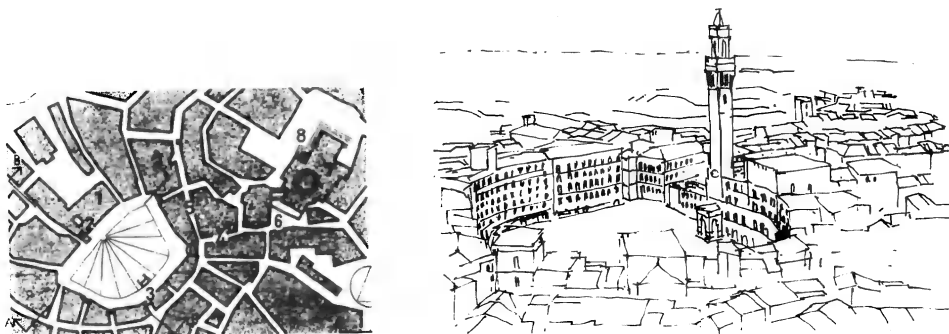


Fig. 26:17. *Il Campo in Siena.* (After Lässig et al.)

ment — United States Operations Mission to Thailand publishes an investigation: »Esthetic Perception of Villagers in Northeast Thailand» (published in Bangkok); 1966 Peter Georg Ahrens, »Die Entwicklung der Stadt Teheran», (1966) a historical plan survey which deals partly with town perception.

While serving in under-developed countries, I experienced how Swedish architects and engineers were annoyed that the natives did not have any sense for maintaining their houses. At this time we ourselves were neglecting city blocks and practically complete towns on purpose, so they turned into slums. Sometimes the building laws even forbade the maintenance of houses; »wear-tear and throw-away» houses like clothes, towns like no-return beer bottles. We are now beginning to understand how unrealistic this is.

The maintenance of old buildings is good, proper and in the long run the only economically sensible thing to do, but even so it should be an even more important task to see that what we now build has a quality, even in the sense of perception, that is worth maintaining. I know that we often plan and build differently nowadays; but for too many decades we and all the rest of the Western world, including SSSR, have almost completely neglec-

ted the aspect of perception. And many towns have been built during this time. Might we dare to hope that soon, very soon, we will change our attitude from »wear-tear and throw-away» to »build-so-that-it's-worth-keeping»? And can experimental research, which I have not taken up here, give us the support that we need when planning our physical surroundings?

VI REACTION

27 Preferences of Townscapes

Using the semantic differential method, I have made the following experiment in collaboration with sociologists: A series of perspective drawings were shown to a number of subjects. They had been created in such a way that two drawings always showed two extreme characters of the outdoor space.

The subjects were given a list of pairs of words, where each pair consisted of one word that is negatively, and one word that is positively, loaded with some aspect of preference. They were asked to plot each perspective drawing on each one of these »semantic scales». The data obtained were analyzed statistically, and the means obtained are shown in Figs. 27: 3, 6, 9, 12, 15 and 18. (The experimental procedure and the processing of the data are described in detail in a report published by the Swedish Institute of Building Research, Document D2: 1971.)

Concerning Fig. 27: 4–5, high–low, it would be rather tempting to interpret this as showing a preference for low external rooms, this interpretation being supported by the better social contact between the children in the play-ground and their mother at the window. But we ought also to observe that the architecture in Fig. 27: 4 is much more monotonous than that in Fig. 27: 5, and if this monotony were avoided then the preference profile might change.

Figs. 27: 7–8, small–large, are evaluated almost equally. This may perhaps be interpreted by saying that we prefer to *stay within* a small outdoor room but to *look into* a larger one.

In Figs. 27: 10–11, shallow–deep, it is obvious that our subjects definitely prefer the shallow room.

Figs. 27: 13–14, straight–rounded, show an unexpected similarity of preference. Unexpected, since we know from experience how much we appreciate a changing view when moving along a street. This does not seem to have been reflected in our simulation since the subject could not move in relation to the simulated street.

Figs. 27: 16–17, leafless–leafy, will be discussed in the next chapter.

In summarising this attempt at interpretation I would like to point out that we must be very careful when intending to apply the results of experiments like these in the practical design of man-made environment; it is to be hoped that further experiments will throw more light on these problems. At least this is what we are hoping for as we continue our present research.

An Attempt at a Hypothesis. — Even though our experiments have not fully clarified the role of the perception of outdoor restricted space in man's total experience of his environment, these experiments, together with commonplace observations, may allow me to formulate briefly the following theory which ought, however, to be regarded as a preliminary hypothesis:

The perception of outdoor restricted space is an essential factor for a »happy life«. This perception can be more or less intense, a high intensity being preferable to a low one. Apart from intensity we can have the following factors or »dimensions«; if we restrict ourselves to the »pure« perceptions (perceptions without attached meaning):

1. High–low
2. Wide–narrow
3. Deep–shallow
4. Large–small (this being a summing-up of 1–3)
5. Open–closed
6. Loosely built up — well defined
7. Room with direction — without direction
8. Rooms that invite us to move — invite us to stay (perhaps just another aspect of 7)

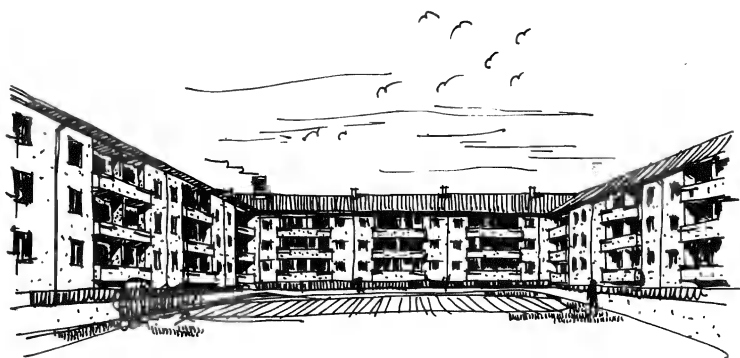


Fig. 27:1. Closed outdoor space.



Fig. 27:2. Open outdoor space.

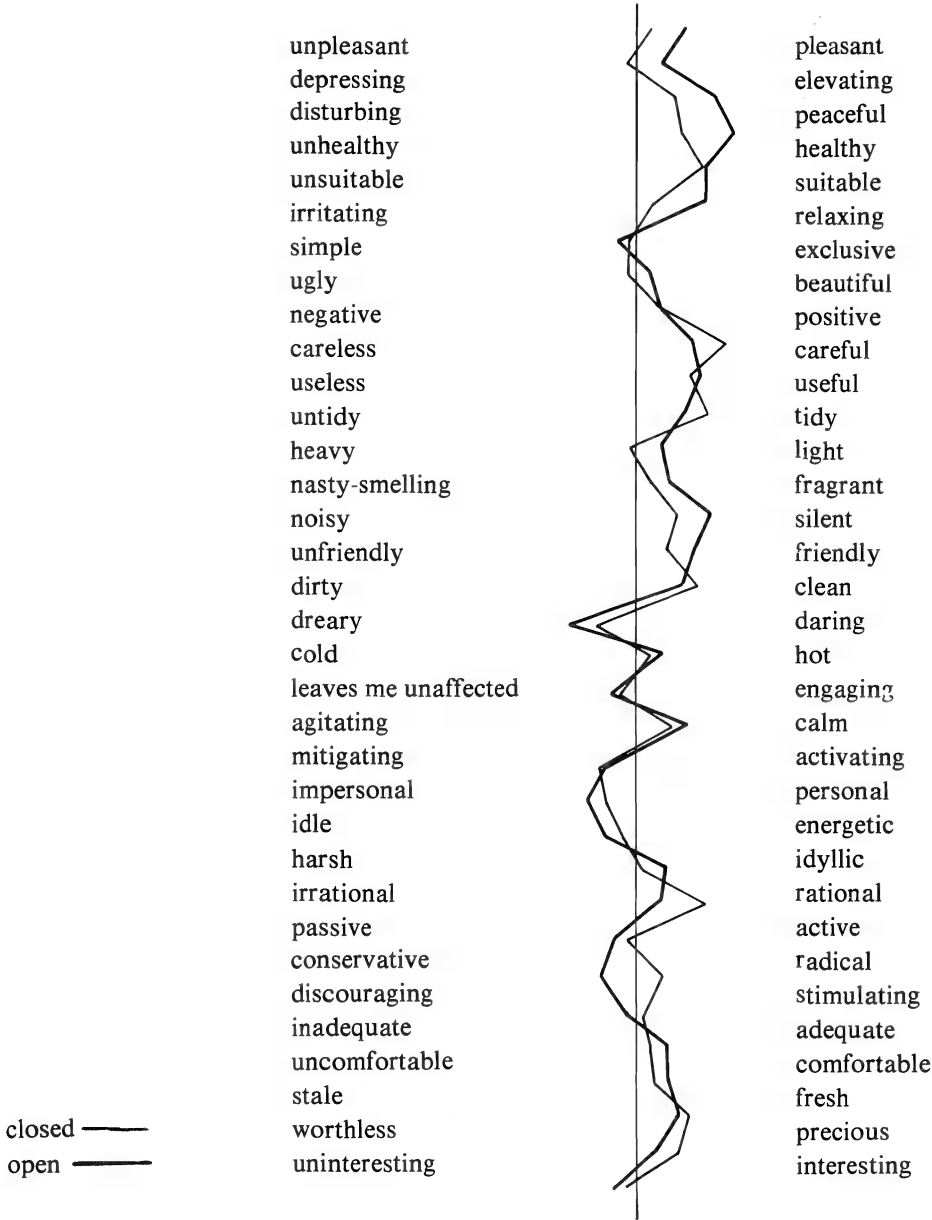


Fig. 27:3. Preference profile closed-open.

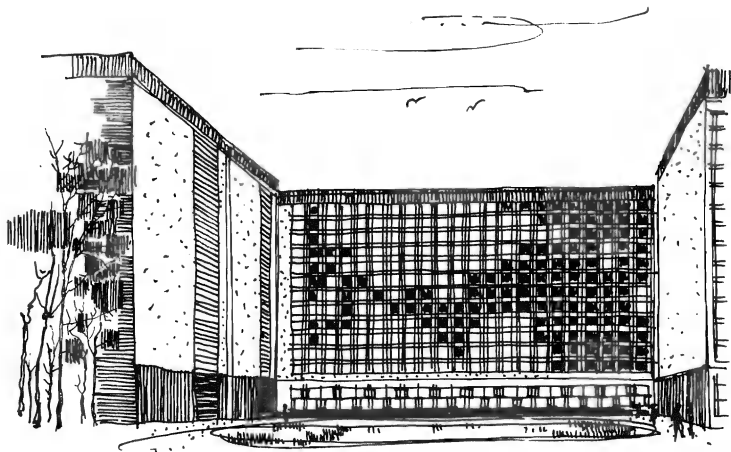


Fig. 27:4. High outdoor space.

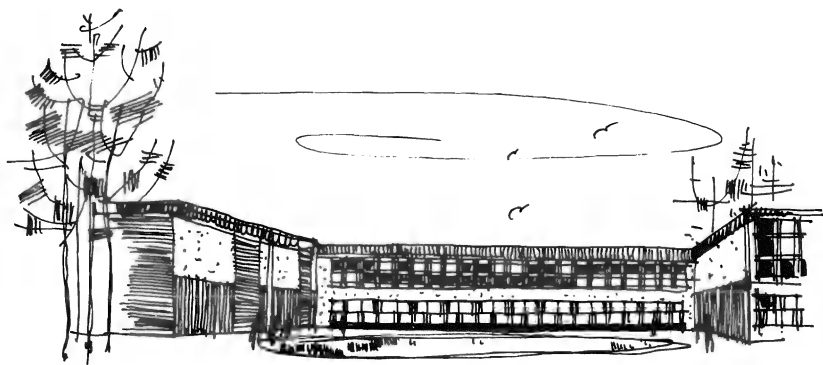


Fig. 27:5. Low outdoor space.

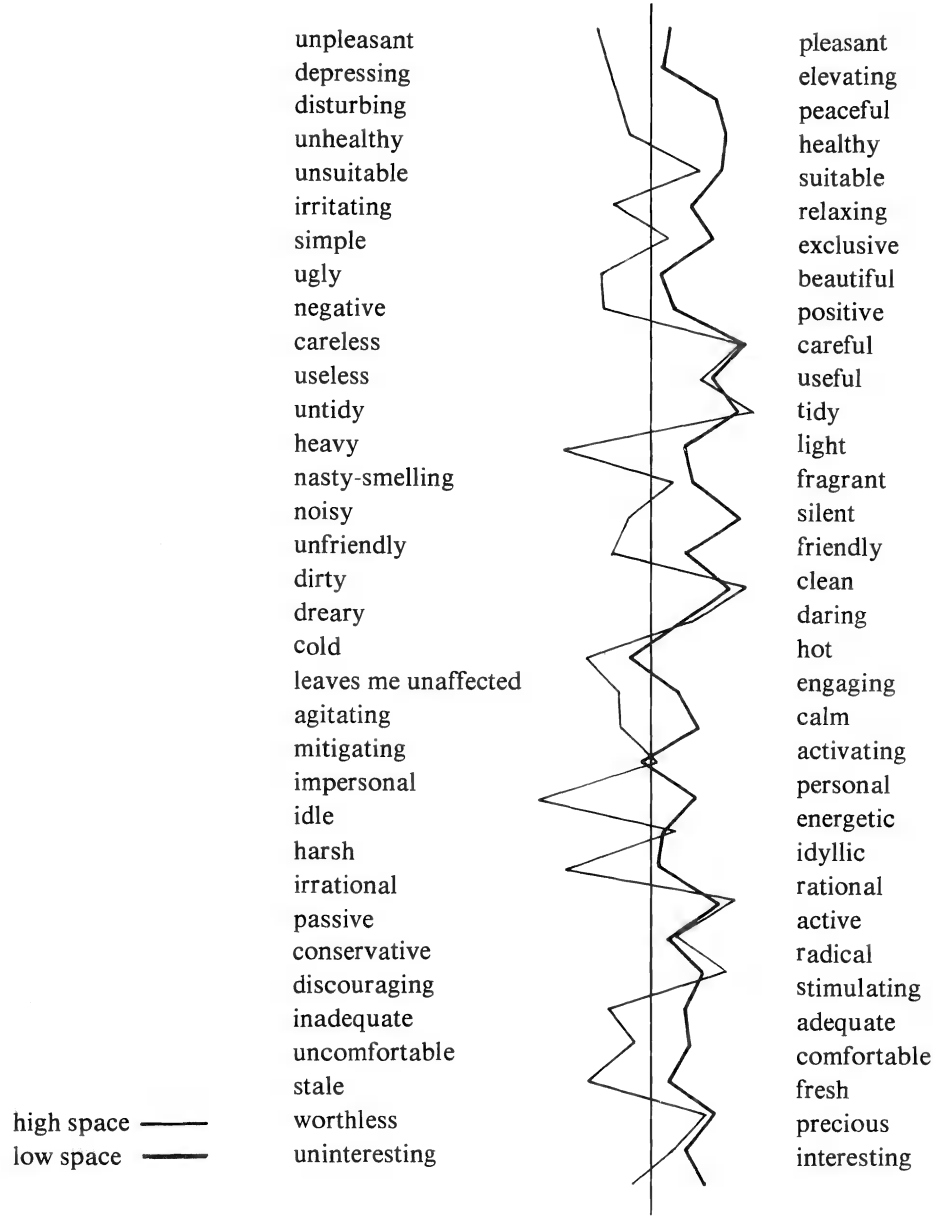


Fig. 27:6. Preference profile high-low.

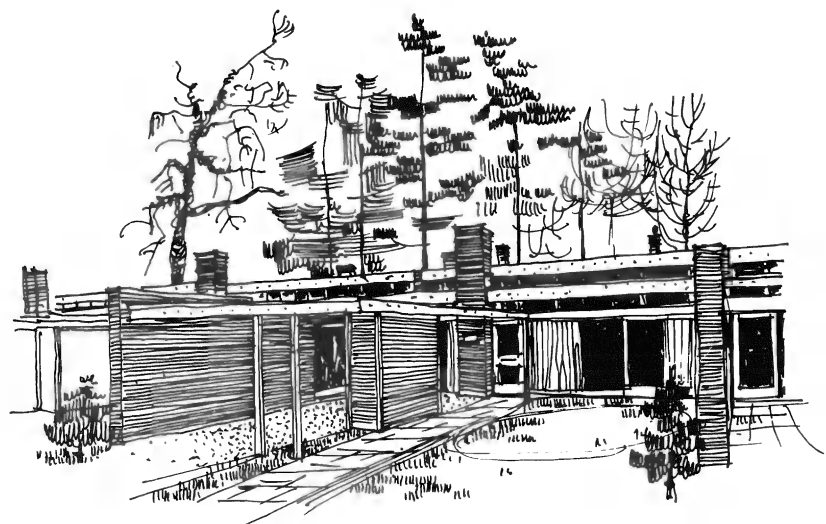


Fig. 27:7. Small outdoor space.



Fig. 27:8. Large outdoor space.

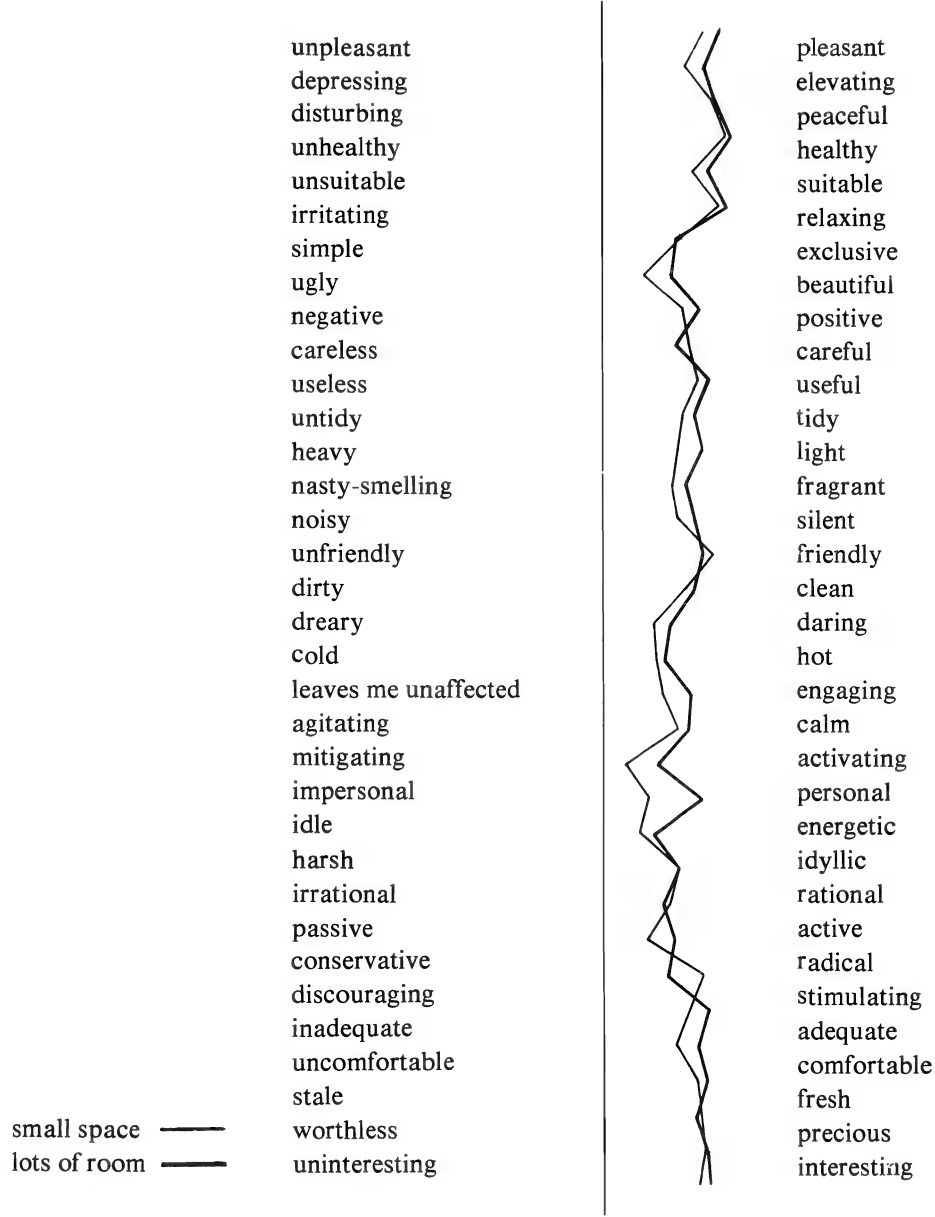


Fig. 27:9. Preference profile small-large.

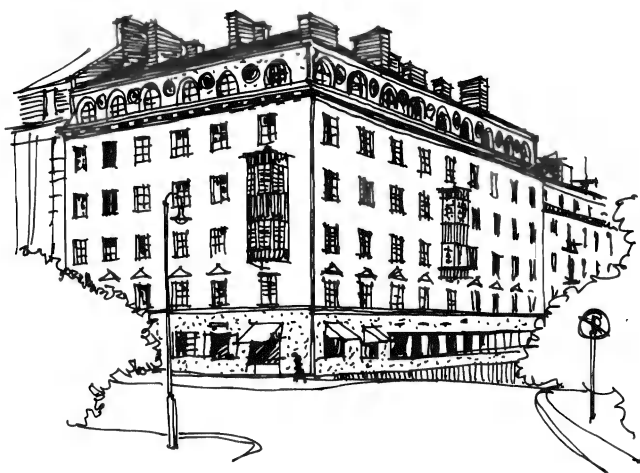


Fig. 27:10. Shallow outdoor space.

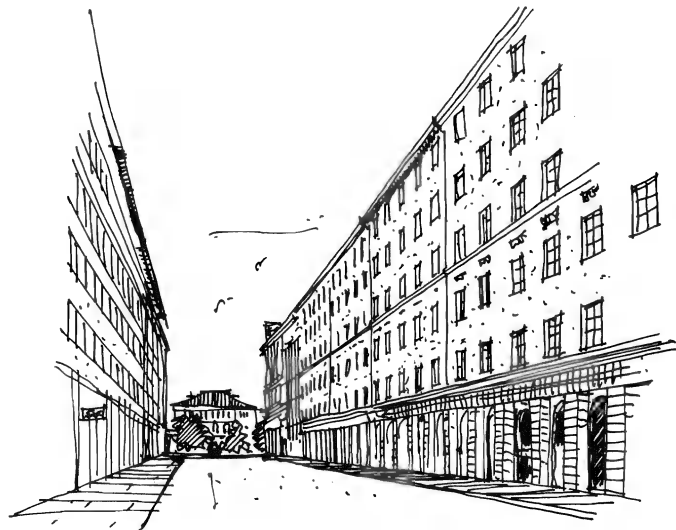


Fig. 27:11. Deep outdoor space.

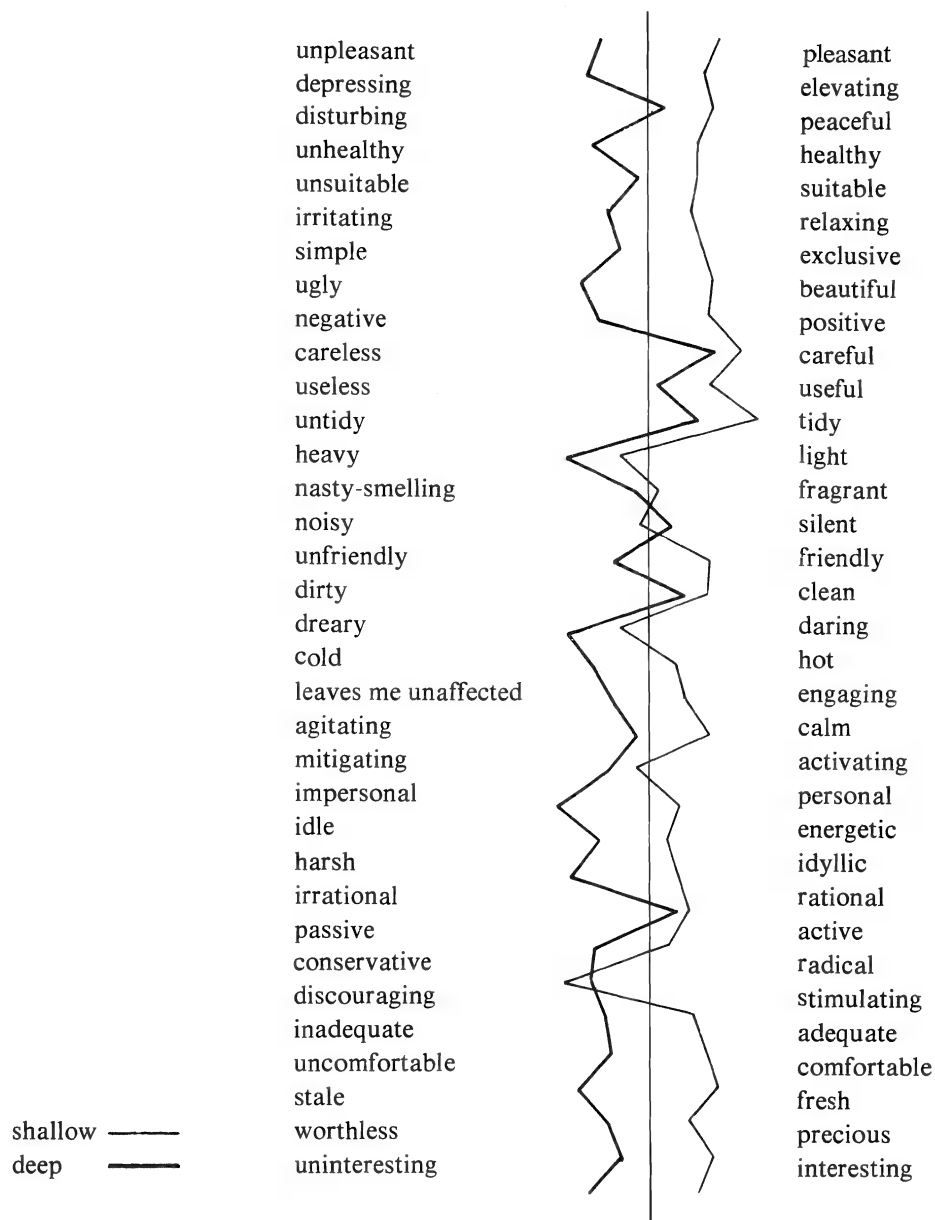


Fig. 27:12. Preference profile shallow-deep.



Fig. 27:13. Straight outdoor space.



Fig. 27:14. Curved outdoor space.

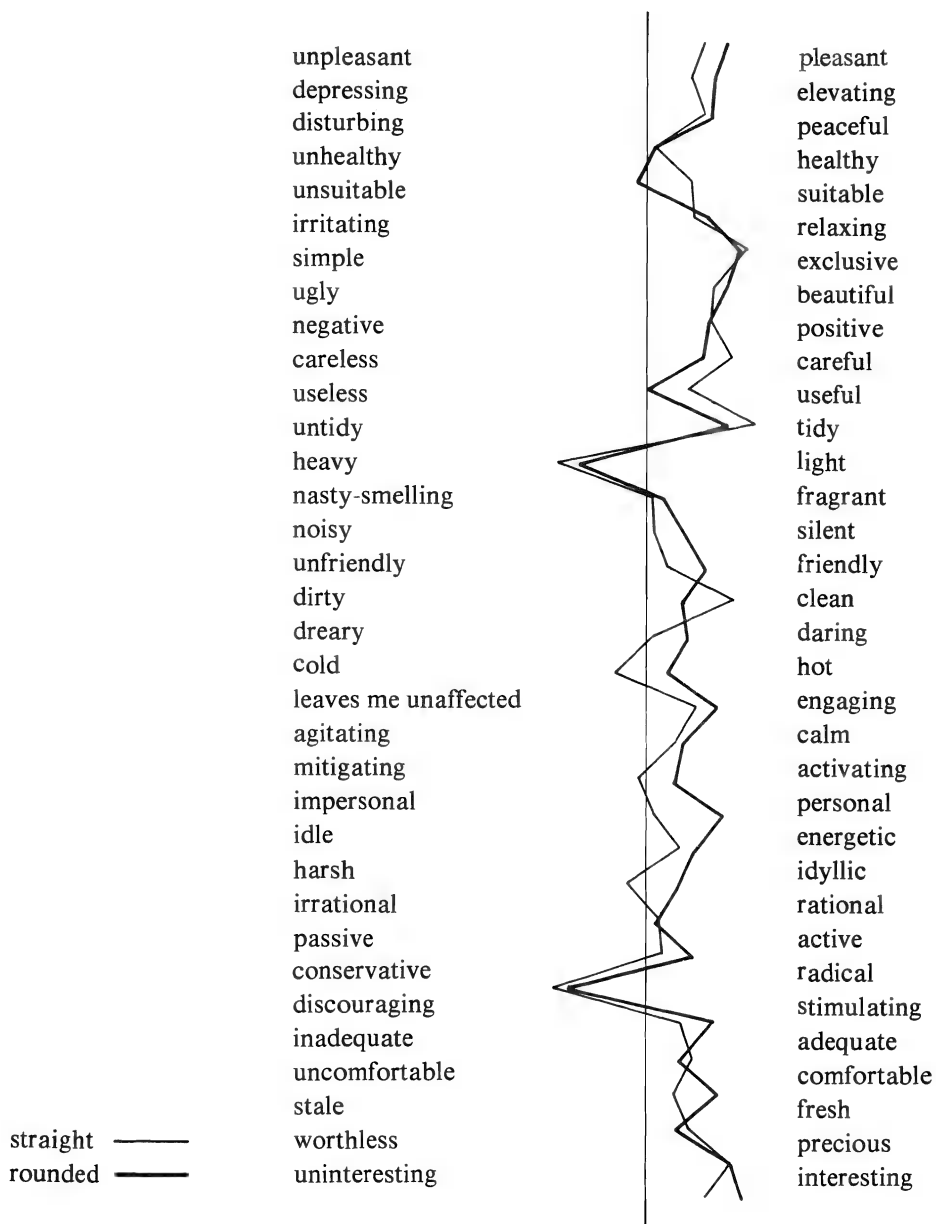


Fig. 27:15. Preference profile straight-curved.

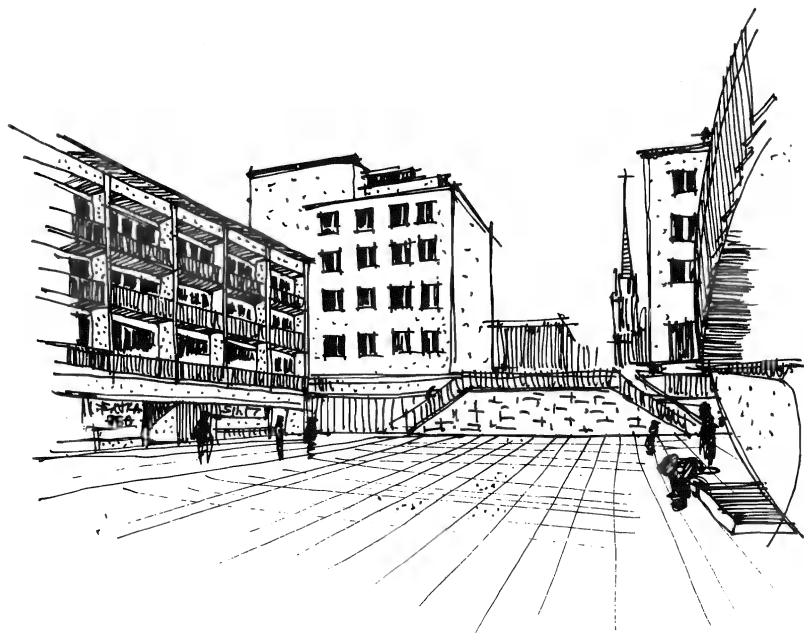


Fig. 27:16. Leafless square.



Fig. 27:17. Leafy square.

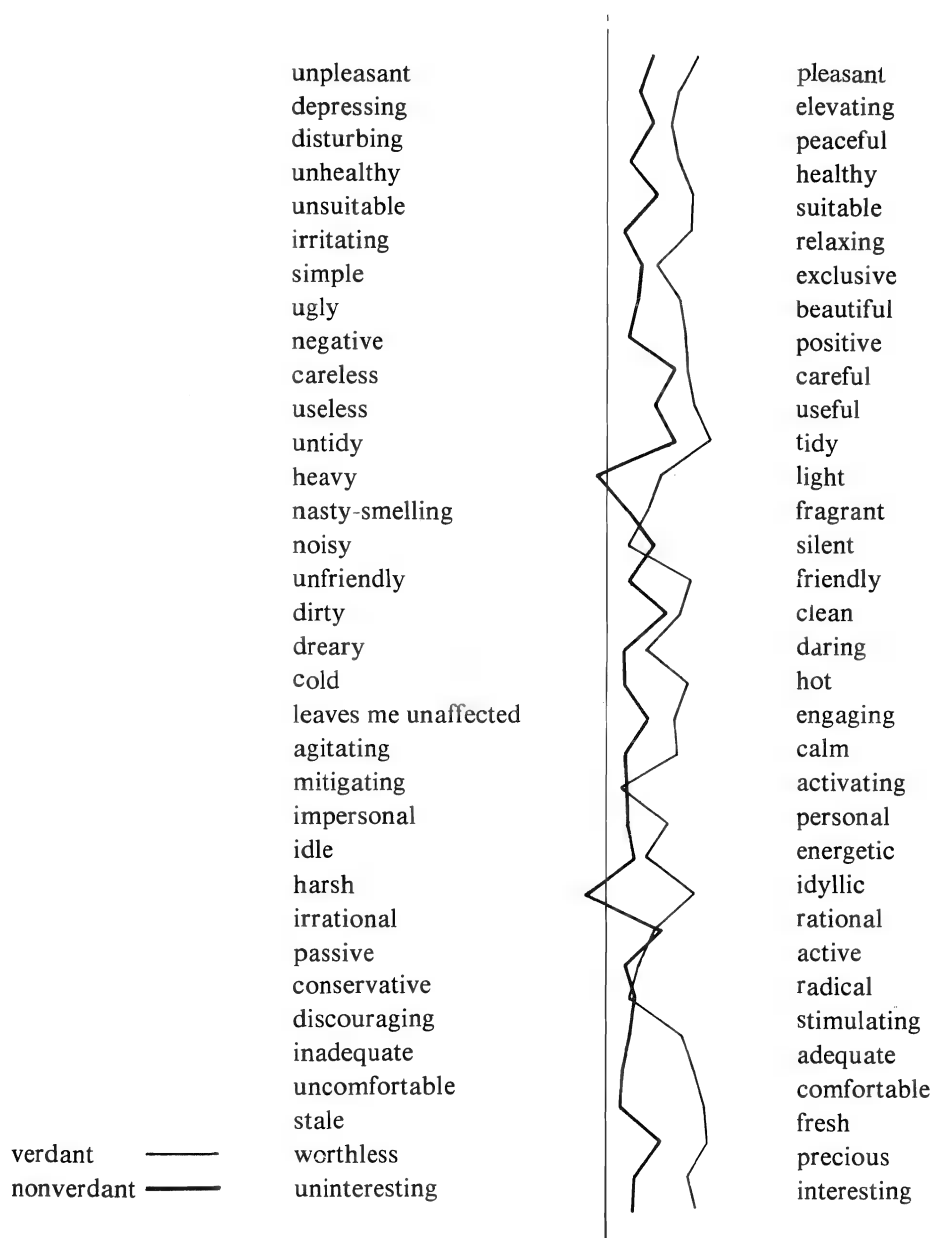


Fig. 27:18. Preference profile leafless-leafy.

9. Monotonous-articulated (may refer to the enclosing architecture but also to the perceived restricted space itself).

These dimensions can vary more or less independently. Thus we can experience a small, closed room which can in extreme cases give rise to claustrophobia, and we can experience a very large room, open or closed, which could give rise to agoraphobia. It seems that we most often require a room which is rather small (but not too small) and at the same time rather open (but not too open), and which is connected through this openness to a larger and possibly more diffusely defined room. When we move in our room, especially if we consider an outdoor room like a street, we have a need for variation, in order to avoid monotony; which does not mean that a completely chaotic room would be best, there is apparently an optimal complexity.

What ought now to be examined experimentally is the extent of the optimal regions: how small ought an indoor and an outdoor room to be, and how open? And is there a special optimal relation between size and openness? And apart from questions of this kind, we ought to examine whether it is true that we prefer a rather intense feeling of being within a restricted space; and how can such a perception be intensified? Is it true that stressing the visual depth by means of Superposition, Texture and Pattern Gradient, Light and Shade, Filled Distance, and Parallax of Movement also implies a stressing of the perception of restricted space?

To my mind, however, the most important thing is that we architects begin to think along the lines that I have sketched here. It may be that we never will have a full clarification of all these problems by means of field studies or experiments in laboratories, but merely formulating the problems might be of good help. Often, a problem formulated is more or less a problem solved.

28 Some Spontaneous and Stable Preferences

Perceptions Needed. — It has been found that perceptions are needed for human beings' survival. It is not just that perceptions give the information required for relevant reactions — a problem which I will touch on below — but

also that human beings need perceptions first of all in order to be awake. Experiments carried out during the training of astronauts have shown how important this is. A human being, who is kept isolated from stimuli, and thus having no perceptions, for some days, cannot function. It is difficult for him to avoid falling asleep and in the end he starts to hallucinate; that is, he gets conceptions or images in various sensation modalities, conceptions which he cannot control or steer by will, and which have the same »colour of reality« as his actual perceptions do. It can be readily seen how dangerous this would be for an astronaut, and even for an ordinary person in an ordinary situation it is important to avoid this happening. We can thus state as our first rule that *perceptions are needed*.

The fact that we need perceptions casts an interesting light on a specific problem that concerns us in our Big Western Cities. We are very much disturbed by traffic noise, glare, and other perceptions, and acoustic and illumination engineers are to a great extent kept busy with the problem of avoiding these types of perceptions. But if all disturbing perceptions disappear the result is a perceptual vacuum, and in accordance with what I have quoted above, this would be a dangerous situation. First of all we need stimulating perceptions, and disturbing perceptions — i.e. perceptions that are evaluated negatively — can sometimes be stimulating *just because they are disturbing*. By this I do not mean to argue against the modern trend towards reducing traffic noise; I merely want to stress that the study of stimulating perceptions is, in the long run, more important.

In close connection with the problem of stimulating perceptions is the problem of avoiding monotony. Experiments with sensorial deprivation have shown not just that we need perceptions, but that we also need variations in these perceptions. Too monotonous a sequence of perceptions has, in the long run, the same soporific effect as having no perceptions at all. I find this so important that I want to quote Marianne Frankenhaeuser, who in an article has made a summary as follows:

»Experimental Approaches to the Problem of Sensory Deprivation and Confinement. A Survey.

A survey is given of experimental investigations concerned with effects of sensory deprivation, confinement, and related conditions, on psychological and physiological functions. Empirical studies have shown clearly that different basic aspects of human behaviour may be severely disturbed under such conditions. The risk for serious disturbances of mental functions is particularly pronounced when bodily movement is restricted and social contacts cut off at the same time as the normal inflow and patterning of sensory stimulation is reduced. However, behavioural efficiency may also be impaired when under much less drastic conditions, such as prolonged inactivity or a monotonous work situation. Research on these problems has been stimulated by the realisation that technical development is leading both to an increased automation of several kinds of work and to increased demands on attention and efficiency. Laboratory experiments permit systematic variation of the duration as well as the severity of deprivation and are therefore well suited for the study of these problems.»

It is evident that we also have to avoid monotony in our towns and buildings. It is, however, evident that this does not imply that we should strive for a maximum of complexity, which would certainly create stress. Concerning this problem psychologists talk about an *optimal complexity*. It ought to be an important and interesting task to find out the limits between optimal complexity and too monotonous one the one hand, and optimal complexity and over-complex perceptions on the other. What, in fact, is optimal?

It cannot be denied that ancient architecture was very often less monotonous than modern architecture, but one can note some striking attempts to create non-monotonous modern architecture. Fig. 28: 1 shows the well-known library at the University in Mexico City. This might be regarded as a proof of man's need for avoiding monotony in architecture, but it might be discussed whether this kind of "tattooed architecture" is really the best way of reaching this goal.

Avoiding monotony also means avoiding order, since too much order implies monotony. This is apparently a trap



Fig. 28:1. University library, Mexico City.

that modern town planners have fallen into: they have made their planning regulations very strict, and this has very often led to too much order. But we ought not to run into the opposite extreme, complete disorder, either. Lynch has analyzed our memory image of a city, and it is easy to interpret his analysis to mean that the city that gives the clearest image also is the one we like best. This cannot of course be true, since Venice is one of the most admired cities in the world but shows a definite disorder like a labyrinth; though it is a disorder within the order of landmarks.

But it is not sufficient just to have perceptions. We also have a need of evaluating them, and if this evaluation is done regardless of the information in the perception then they can give rise to what I have called formal aesthetic evaluations. If we take the architectural expressions into account, we talk of architectural evaluations. Apart from what has already been said about these, however, we can also find the following:

Appraisals of Meanings. — When we are roving in the hills we may sometimes perceive bright light and deep

shadow in contrast. This variation in lighting is something that we spontaneously appreciate. But if we look a little deeper into what it is that we are evaluating, we find that the bright light "is" glimpses of sunshine and the shadows "are" cloud shadows. Light and shadow give us information about the existence of the sun, and the depth of the need for this information is clearly illustrated by investigations which have been carried out in Sweden and in the Netherlands. The result of these investigations can be briefly summarized as follows:

The physiological hygienic effect of the sun shining in a room is very little, almost zero. And as working illumination it does more harm than good. But in spite of all this, people not only appreciate the sun shining into their homes but seem to be unhappy if this is not possible. But it is not that they like to sit in the sunlit room; they very often spend all their time in rooms where the sun cannot enter through the window. It seems sometimes to be sufficient for them just to know that the sun *can* shine into one of the rooms in their dwelling. This spontaneous appreciation for the perception of Father Sun has of course been observed long ago, and the Swedish Building Regulations state as a general principle that every newly-built block of flats shall be planned in such a way that every apartment has a least one room into which sunshine can enter.

From everyday experience we know that we appreciate seeing Mother Earth just as much as Father Sun. We know for instance that most Westerners prefer to live in houses with gardens where they can literally see our fertile Mother Earth in function. We can also say that Mother Earth is not the only Mother; she has a twin, mother Sea. And the appreciation of Mother Sea is mirrored in the high price of those villas near the shore which have sea views. As far as the author is aware, no-one has carried out large-scale experiments or field research to investigate how happy we are to perceive Mother Earth and Mother Sea, but perhaps such experiments are unnecessary? Don't we know this sufficiently from common experience?

In his book »The Naked Ape«, Morris tells us about a preference-scaling of animals »involving 80 000 British

children between the ages of four and fourteen». One group of animals was evaluated positively, another negatively. A common feature of the preferred animals was that they were furry and had some kind of human facial expression. At the top were the ape and the horse. The negatively ranked animals lacked these features; at the bottom was the snake. The result of this investigation implies that *we want to perceive our Brethren the Furry Animals*. This preference is, for instance, mirrored in our habit of keeping domestic animals, such as dogs, who have been domesticated according to our will for thousands of years until we have got them created as we want them.

But we do not only want to perceive animals, first and foremost we want to perceive human beings.

Perceiving human beings and their activities is not, however, an aim in itself, but it can lead to social contacts. The importance of these social contacts within a town is stressed by Jane Jacobs. In many parts of the world where an old culture has been developed, people come regularly to an established market place, not only for buying and selling but primarily for seeing each other and talking to each other. Apparently, Perceptions of Man-made Environment can act as a vehicle for these Social Activities. An interesting study of the Social Aspect of Perception in Town Planning has been carried out at the Department of Architecture at Kunstakademiet in Copenhagen.

Under the heading »Perception and Information» I have talked about the Architectural Expressions as information relevant to man's activity for meeting his needs. It seems that the wish to experience this can be demonstrated in many ways, but I want to stress here that the most important thing is that we have a need for experiencing all the five kinds of meanings discussed here *at the same time*. *The five meanings are thus:* I) Father Sun, II) Mother Earth (and her twin), III) Our Brethren the Furry Animals, IV) Ourselves, V) Our Own Activity for Meeting our Needs. An example will clarify this:

When we are strolling in a forest we certainly appreciate the perception of Mother Earth, and if the scene is like

that in Fig. 28: 2 then we can also perceive Father Sun. Having a dog by our side gives us a strong feeling of comfort, but nevertheless we cannot stay very long in the wood before we begin to feel uncomfortable. Even if the sun goes on shining and we do not need any shelter from rain, and even if it is not cool, we begin to long for some traces of human activity. Seeing a little house in the wood make us feel happy, especially if we can go in and take the indoor room into our possession. This leads us to the question of the perception of restricted space. But before we go into this let us have a look at Figs. 27:16, 17 and 18. Fig. 27:16 shows a bare room. As seen in the preference-profiles in Fig. 27:18, our subjects have appreciated this manmade environment in all respects. But the appreciation is increased when the same bare room becomes verdant as in Fig. 27:17, i.e. when we can also perceive Mother Earth, as can be studied in Fig. 27:18. We see here that the appreciation is increased in all respects when man-made environments is combined with vegetation, a manifestation of the fertile earth.

Perception of Restricted Space. — Modern architectural theorists express unambiguously the opinion that the

Fig. 28:2. Forest in chiaroscuro.



perception of enclosed space — or restricted space as I prefer to say, to avoid confusion with the closed-open dimension of restricted space — is of utmost importance when discussing the appreciation of architecture, outdoors as well as indoors. Especially when thinking of townscape it must be said that modern architects have demonstrated that they have lost the ability to handle restricted space consciously. The old masters have undoubtedly given proof of their superior skill, as has been clearly demonstrated by the authors who have studied these old masterpieces.

However, it must be stressed that the "form" — in this case the architectural means — is of no value if the "content" — the human beings — is missing. Just as an example of this I might report an experience of mine. I had read de Wolfe's description of the old Italian town Sabioneta. He stresses how T-traps in the streets block the view almost everywhere so that one can not see the surrounding landscape. (see Fig. 26:15.) This was consciously planned, he argues, just in order to give the inhabitants a pleasant feeling of protection. During a trip through Italy I found the town and I was able to state that de Wolfe was certainly right. But my three sons who accompanied me exclaimed unanimously: »What a gloomy town, no people here!«, a fact which at first sight had not caught my attention. Sens moral: Do not rely upon an architect's professional appraisal!

The experimental study of Townscape in general, and of Outdoor Restricted Space in particular, ought, however, to be something important. But as far as the author is aware no-one had tried to tackle the problem of outdoor restricted space experimentally until we made our first attempts in 1966.

29 Architectural Socio-Psychology

The title of this book is Man's Perception of Man-Made Environment. When talking about factors influencing behaviour and evaluation, however, we touched upon something else, namely: how the social situation can influence the aesthetic evaluation. However, we also find that our perceptions can influence our social behaviour.

In order to say something about this other aspect I will describe an approach worked out by the young Danish architectural theoretician, Jan Gehl.

	Possibilities of experience (one-way-contact)	Possibilities of activity (two-way-contacts)
Physical Environment Man-object relations	1 look at buildings and towns	2 sleep in the house live in the town
Social Environment Man-man relations	3 listen to people touch people	4 exchange ideas make love with one's wife

*Fig. 29:1. A Square Model
of man in town environment.
(After Gehl.)*

The model should be interpreted as follows:
Our environment is comprised of our fellow human beings,
of objects, and of nature other than human beings.

Our fellow-men provide our *social environment*. The *physical environment* is comprised of everything else but the people. So, we can experience (perceive) partly the physical environment and partly the people, their voices, their appearance and so on; this is what we might call a one-way contact. But we can also let our experience (perception) of the physical environment lead to action. We can, for example, use the objects. Our experiences with our fellowmen can also lead to activity together with them. The condition for this is that a two-way contact is established. So according to our model we get four different types of situation. Before beginning to discuss the four squares in the model, one by one, we must of course remember that the model is rather crude. It does not cover the many-shaded variety that occurs in real life, but it is sufficiently elucidatory for our purposes.

1. *How people experience (perceive) their physical environment.* — This is a question that has commanded interest at all times; it has been the subject of all traditional architectural theory. How the modern psychology of perception can provide a better basis for our understanding of this one-way contact has been the subject of my own studies for several decades. Amongst the one-way-contacts to which this square is applicable are, besides architecture, some of the fine arts (painting, sculpture). Theatre as an art is an application of square 3, being concerned with one-way contact man-man.

2. *How people use their physical environment.* — This might sometimes be applicable in art, namely when one is concerned with the manipulation of gadgets. Playing with a mechanical toy sometimes belongs under this heading provided that you can exert some kind of control over it (steering a model plane, for example). But on the whole it is concerned with what we call architecture: we eat with a spoon, sleep in a bed, live in a house. With the beginning of functionalism this aspect became the object of a more thorough study from architectural theoreticians than before.

3. *To see, (talk to, touch) other people.* — This is obviously a prerequisite for social activity.

4. *To act together with another person (other people).* — This is about activity which is a necessary condition for human culture, because the patterns of our culture are mainly traditionary and not inherited. Through inheritance we have a more or less developed personal ability to utilise the traditionary material and further develop it.

Now, if it is obvious that the architectural theoretician, having square 1 as basis, has gone over to square 2, it is just as obvious that the dimension 3 is a neglected dimension, and this is to an even greater degree the case with 4 which must simultaneously pass 1-3 and 1-2.

Why then is it so important to include dimension 4 in architectural theory? The question is justified, and I shall try to answer it as briefly as possible.

Since we get our culture patterns through tradition and not through inheritance, and because the first years of our lives — before school age! — are the most important ones for enabling us to adopt cultural patterns, it follows that square 4 in our square model is of the greatest importance during pre-school age. (It is sufficiently proved that one grows up into a human being mainly through being together with people of different ages and with different norms for evaluation. Without such social contacts one grows up to be anti-social in the full meaning of the word. »Disturbed children lie on their stomach with their face to the wall, something which is of diagnostic significance for this condition; they avoid social contact and refuse to look at anybody in the face.« The quotation is taken from Konrad Lorenz' »Aggression«, with reference to Rene Spitz' observations of orphanage children, who had insufficient social contact with other people.)

Then there is the other problem, that the young, when they have grown up, are supposed to establish a better society than the one we have now; but in order to be able to do this they have to have something on which to build. A social union cannot be established without a firm base.

Well, how does the modern town provide for the child's needs in squares 3 and 4? It is said that we live in a mobile world; everyone owns a car and can move wherever he wants to go, and our dormitory suburbs are used only for sleeping. This picture is wrong. It is true that fathers, mothers and bachelors who have jobs drive their cars to work, but others remain at home. Which others? People who are handicapped, old-age pensioners, children, grown-ups who are looking after children (housewives), and those who are too poor to own a car. None of these people can get into town and in their apartments they are not in situation 4. This group within society constitutes about 55% of Europe's population. (The figures in this example and the following ones are quoted from Jan Gehl.) The more cars we get, the worse the situation will become. In Los Angeles, 66% of the ground is taken up by driving and parking areas for private cars. Here 65% of the population do not work outside their homes. They cannot leave their homes on foot because there are no sidewalks. Riding a bicycle is peri-

lous, and buses and street-cars are rarities nowadays. So the car, which was supposed to enable us to move about, has for most of us had the opposite effect.

The solution of this problem cannot be getting rid of the cars, but planning our housing areas to provide for situation 4. At the same time, of course, we must not neglect the fact that people sometimes may want to be alone. One should not be constantly *forced* to be together with other people.

Obviously our new dormitory suburbs do not meet the requirements which we are discussing here. It has not always been like this. The reason for our great admiration for the »typical» medieval towns is that they provided for the whole of our square model. This is something that we often have a feeling of, without being able to point out the reason why. The things that people were trying to achieve in those days, often during centuries of »sketching» in full scale and with real material, (Venice for example; see Bacon), we have to achieve rapidly and by conscious thought. We cannot afford to rebuild our towns like they once used to.

Of course town planning directly influences situation 4, since the physical forms of the streets directly governs our movements in town. If we move down our town's one narrow street, we will have an opportunity of seeing many people — situation 3 — which can lead us into situation 4 if we so wish. But don't forget that situation 3 is already of value in itself. On the other hand, if we must move on many scattered, small paths through »semi-parks», shops and other premises get spread out and there are fewer possibilities for contact. The perception both of the physical and social environments can in part be a means of getting into situation 4 and partly be of value in itself. Last but not least, this seems to be true concerning the perception of restricted spaces in town environment.

I hope I have made it clear that »the forgotten dimension» (Jan Gehl's term) is a fatal question in our culture, one question amongst others. It is therefore of the greatest importance that research be done in this dimension.

30 Fundamental Needs — Summary and Conclusion

Starting with a development of the model by Jan Gehl which is described in Chapter 29, I will now try to summarise everything that I have discussed so far in a comprehensive model, as follows:

Jan Gehl’s original square model is thus developed into one with ten parts, and I will start by discussing them one by one.

PERCEPTIONS	ACTIVITIES
1) »PURE» SENSATIONS	2) INCREASED ACTIVITY LEVEL
3) MEANING INERT NATURE	4) CHANGE PHYSICAL ENVIRONMENT SPORT AND PLAY
5) MEANING LIVING NATURE	6) HUNTING, EATING, AGRICULTURE
7) MEANING INERT ARTEFACT	8) HUMAN LIVING OBJECT—CULTURE ARCHITECTURE SPORT AND PLAY
9) MEANING HUMAN BEING	10) SOCIAL INTERACTION HUMAN CULTURE

Fig. 30:1. Perceptions
and connected activities.

1) »Pure» sensation — This includes experiences of visual form, colour etc, the basis of fig. 30: 1.
We have a fundamental need of receiving a sufficient amount of these ”pure” sensations.
Arguments: See Chapter 28.

These experiences must not be too monotonous; we might talk about an *optimal complexity*.
Argument: See Chapter 28. What »optimal complexity» would be is however not yet clarified by experiment.

The »pure« sensations are — often subconsciously — evaluated aesthetically as beautiful or pleasant, or ugly or unpleasant, or something between these extremes. Things that we appreciate stimulate us, and we appear to have a fundamental need of making these »formal aesthetic« evaluations.

Arguments: See Part II of this book and, for more detailed studies, Part Two of my book *The Language of Architecture*. I will only remark here that some of the structuring (»pregnant«) phenomena in the different realms of sensations (perception modalities) have a character of relaxation that we very often appreciate. The transformation tendencies also play an important role in our appreciation; I refer especially to Chapter 13.

2) When we get »pure« sensations, our activation is stimulated; we enter a level of *increased activity*. — It might be mentioned here that, according to modern theories, this depends on the electrochemical nerve impulse, started by an external physical stimulus entering a sense organ, taking two paths; one direct to a certain part of the brain where a sensation is awakened, the other to the reticular formation from where impulses are sent out to all the sensory parts of the brain, thus activating them. This increasing of our activity level must be looked upon as a *fundamental need* during work. When relaxing, however, we might need a decreased level of activity, that is, a smaller amount of sensations, which means a smaller amount of stimulus.

3, 5, 7, 9) *Meanings*. — Please look at Fig. 14:3, p. 71. At top left you will see a drawing of a man's face, at bottom right a handsome young girl. As you go towards the right, starting from top left, "man's face" shifts gradually to "young girl"; somewhere in the middle you are probably not quite sure what the drawing "is". Much thinking has been devoted to speculations about this shift. But let us now make an experiment: Try to perceive a nonsense figure in Fig. 14:3, a form with no meaning at all! You will probably find this absolutely impossible. We are, apparently, subconsciously looking for meanings in everything that we see, hear, touch, taste, and so on; in fact, in every sensation. We have a *fundamental need* of experiencing meanings in our perceptions. (Some authors talk on this subject about "interpretation" instead

of "meaning". We interpret forms, etc, in one way or another.)

3) *Meaning inert nature.* — In a wood like the one in Fig. 28:2, p. 198 we see some parts lit up and some parts dim. But the light has the meaning sunshine, the darkness the meaning wood-shadows. And we have a tendency to appreciate these meanings. We have in fact a *fundamental need* of perceiving the meaning Father Sun.

Argument: — See Chapter 28, see also L. Holm, G. Pleijel, and H. Ronge, "Bostad och sol" (Dwelling and sunshine), Byggeforskningens report nr 100, Stockholm 1964, and C. Bitter, "Waadering van zonlicht in huis" (Evaluation of sunshine in houses), The Periodical Bouw nr 41, The Netherlands, 1962.

To »meaning inert nature» we also have to consider the earth as far as the mountains, rivers, and other physical features, are concerned. When we think at the earth as *Mother Earth*, however, we draw our attention to her as fertile earth, where grass and trees can grow. I will therefore take her up to discussion in point 5.

4) Experiencing the meaning inert nature in our sensations most often gives rise to activity. We want to *change the physical environment* in order to make it suit us better. This is often a *fundamental need* essential to our survival, and we may observe that man is the only animal who has been able to so change his surrounding microclimate that he can survive both on Greenland and in the tropics. This need is so self-evident that no further *argument* is needed. But, we can also use inert nature for *sport and play*.

5) *Meaning living nature.* — In the wood depicted in Fig. 28:2 we see the traces of the fertile earth; the forms that we perceive carry this meaning. We have a *fundamental need* of perceiving the meaning Mother Earth.

Argument: — See Chapter 28. In addition to this I translate here an article written by Mailis Stensman, from the Swedish periodical Form, which arrived in my letterbox yesterday. It is a description of an experiment.

»This is where we want to live!

»More than 1 000 children in the town of Lund have taken part in an exhibition with the theme 'this is where I

would like to live'. Invitation to take part had been made to children both individually and collectively through schools and kindergartens. There was no censorship of the entries; everything that came in was put up, crammed onto the walls of Lunds art gallery. The idea of having the exhibition came from the Swedish sociologist Silvija Altenhammar. The exhibition was too short (one week, between two regular exhibitions) and the allowances for theatre, films, different kind of materials, toys, soft drinks and cakes, etc., were not generous.

»Where do children want to live?

»Small children usually want to live where they already do, or in a bungalow with a garden; or in the traditional Swedish red-painted wooden cottage or half-limbered house with neat flower-beds, the Swedish flag flying from its pole, and a garden fence. Loneliness and isolation were sometimes specially expressed by a stone wall, or 'Beware of the dog' notices, and worst of all, by cannons on the battlements of a fortified castle with sharks in the moat round its foot.

»Many children wanted to live in a hideout up in a tree, in the jungle amongs flowering vegetation and exciting animals, in a red apple, in someone's soft mouth

»The older children, who listen to and follow the debate about environment, had precise requirements throughout for clean air and traffic-free towns, for having opportunities for being together and talking with one another, for having somewhere to go that is green and clean.

»They all wanted greenness and they all wanted to live down on the earth!«

6) Some examples of activities started or made possible by the perception of living nature are *hunting, eating, agriculture*, etc. No *arguments* for the *fundamental need* for these activities are required here.

7) *Meaning inert artefacts*. — This is the realm of study almost exclusively dealt with in Architectural Theory until now. How this study can be based on modern Psychology of Perception is the subject of my book *The Language of Architecture*; *arguments* for the opinion that there is a *fundamental need* of perceiving this meaning can be found in this book.

8) The perception of this kind of meaning can give rise to several kinds of activity; first of all, *the handling of the equipment* used in our daily life; the development of what might be called cultural behaviour (the use of a knife, fork and plate when eating, for example); the construction of our man-made environment, sports and play. For *argument*, see The Language of Architecture.

9) *Meaning human beings* — a value in itself, that can also give rise to

10) *Social interaction* resulting in *human culture*. *Argument*. — See Chapter 29.

As far as I can see, the fundamental need for all of these kinds of meaning that are attached to basic perceptions must be fulfilled, if we want to live a satisfying life as human beings.

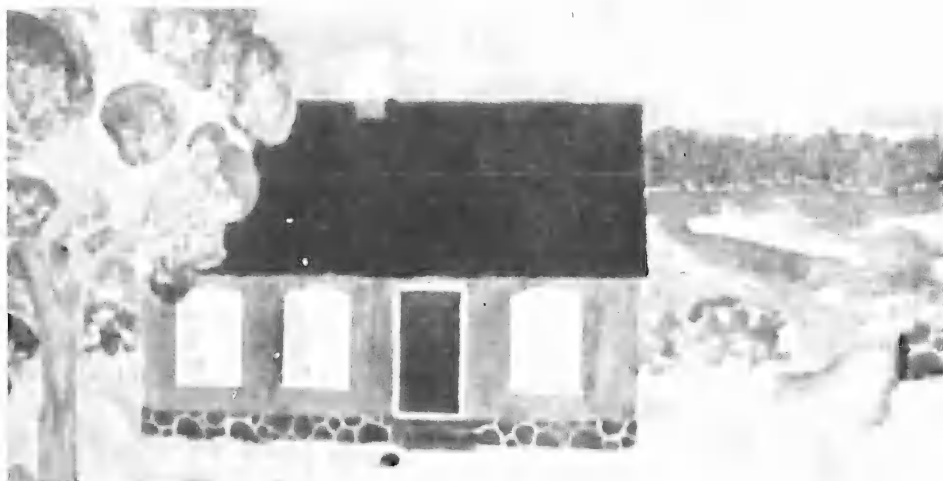


Fig. 30:2. Under this drawing by a Swedish school child the following is written: "I want to live in a red wooden house in the country. Four rooms and a kitchen. Orchard and fruit bushes. The garden ought to be wild, with a few flowers here and there. Hedge round and a stonewall between the garden and the road. I want to have a dog and a cat." — Isn't this the dream we have all of us?

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